*Journal of the American Foundrymen's Association.*

VOL. IX. MAY, 1901. PART I.

# NOTES ON FOUNDRY PRACTICE.

By MR. EDWARD B. GILMOUR, Milwaukee, Wis.

By correctly knowing the results of combining the different elements which enter into a mixture, and having experience, through practice, the founder of to-day is able to intelligently mix his iron to suit various requirements in every particular, and not trust to chance, as was formerly the case.

Foundry management is now becoming a science and therefore he who directs the foundry must learn to understand the science of foundry practice or he will, in the near future, be seriously handicapped. At first sight, in looking over the analyses of pig irons and noting the ratio of the different elements which are in combination therein, the percentages of these elements seem so small that they do not appear worthy of consideration and should not affect the casting. If you compare the analyses of the different forms of iron you will see how little carbon it requires to change iron into steel, and it is only when you get a correct knowledge of the effect of various percentages of the elements in iron that you will be able to bring your experiments to a successful termination and not trust to chance or be imposed upon by every agent who comes along to sell pig iron. For castings requiring a special mixture of metal, such as cylinders, it is impossible to use what is termed scrap, as its composition is so variable that you do not know what you may expect to turn out.

Pure iron is of no use for commercial purposes, it is too soft and very difficult to melt; the iron that is used for foundry purposes is easily melted, as it is an alloy of a number of elements. Foundry irons are grey or mottled, and are divided into grades, and are numbered according to the quality as shown by the fracture, but with the advancement which is going on at the present time these numbers are gradually being abandoned and

XUM

iron is ordered by chemical analysis to better suit requirements.

The principal and most effective element other than the iron that we have to deal with in cast iron is carbon.

## CARBON.

The various percentages of carbon in iron determines the quality of the metal, whether it is cast iron, wrought iron or steel. Carbon is a tasteless and odorless body and is practically infusible; it exists in three forms, two of which are crystalline (diamond and graphite), and one amorphous (charcoal). For our present purpose we have only to consider it as it exists in combination with iron, which is in two distinct forms, viz., a graphitic and combined carbon. When it is in the graphitic state the cast iron is soft and easily fusible; it enters to the extent of 2-4.5%, and in steel from .07 to 1.35%. In wrought iron it is in many cases hardly perceptible. There is no strict scientific dividing line whereby we may be able to judge when the sample has passed into steel, cast iron, or wrought iron, so that these terms have really only a commercial meaning which is determined by the amount of carbon present and the mode of manufacture. This is the element which most of all determines the strength of the metal. Graphitic carbon is always present in iron in a mechanical form, and is easily distinguished from the other form, which is in the combined state. This combined carbon is known to exist in several conditions, but there has not been any good method for separating them devised as yet.

## SILICON.

The next important element which we have to consider is silicon, by a judicious use of which the founder may change the combined carbon to the graphitic, or vice versa, as he requires. When carbon has all become graphitic the further addition of silicon has a hardening effect. Silicon is not a softener of iron, nor is it a lessener of shrinkage, but through its action on carbon and only for a given range does it produce these effects. The loss of silicon in remelting in the cupola is not heavy, and cast iron which contains just enough silicon to prevent hardness and give a solid casting is the best composition to use. If strength be more important than softness we can leave the greatest

XUM

amount safely possible of the carbon in the combined state, without, however, causing the iron to be too brittle.

Silicon being introduced into carbid of iron will throw out graphite, but if you have manganese carbids or titanium carbids present silicon will not be as effective. Silicon combines very readily with iron, but for foundry purposes from 1 to 3% is the range, according to the class of work in hand, the thicker the casting the less of it being required.

## MANGANESE.

Manganese alloys with iron to an unlimited extent. Beyond hardening it has no very detrimental effect upon the metal, but in many cases it is even beneficial by making iron readily susceptible to chill and close in the grain, and assists in eliminating blow-holes. Care must be taken in using this element, as it increases shrinkage, and if the design of the work is not in accordance with the laws of crystallization it will cause the casting to crack very readily. One good feature of this element is that it removes sulphur to a great extent and thus prevents red-shortness. The percentage of manganese is reduced very heavily in remelting in the cupola, so that about .8% of it in the original pig for heavy castings would be about right.

## PHOSPHORUS.

Phosphorus weakens iron, more particularly when it reaches 4 or 5%. It is very beneficial in stove irons when about 1%. It reduces shrinkage. High phosphorus irons should be poured at a lower temperature as it renders the metal very fluid, everything else being normal. Phosphorus causes cold-shortness or brittleness when cold.

## SULPHUR.

This non-metallic element combines with iron very readily at low temperatures. It is undoubtedly the most injurious element that we have to contend with in foundry mixtures, and causes iron to be weak. It also makes iron white and hard. Sulphur is not readily removed from the iron in remelting, but it is found that the temperature of the cupola has an effect on the percentage of sulphur in the iron. At high temperatures the

sulphur will tend to go into the slag, as there is not so great an affinity between iron and sulphur under these conditions, and the iron becomes better. If at any time you have to stop the blast or reduce the pressure of the wind in your cupola while melting it will reduce the temperature, and, consequently, the sulphur of the coke will unite with the iron more readily. When this element is present in iron it increases the combined carbon and affects the crystallization somewhat. In buying iron you sometimes get iron high in silicon, high in sulphur, high in combined carbon and low in total carbon, the iron showing a very good fracture in the pig but if cast in a chill mold a sulphur chill, independent of the silicon, will quickly show up, indicating that this iron is not suited for very light castings or castings which are to be machined. Again, if you put iron into the cupola which is comparatively free from sulphur and do not melt it very hot it will absorb the sulphur from the fuel and your castings will be high in sulphur. High sulphur castings are filled with blow-holes and not easily machined, and when the molten iron comes in contact with the damp sand a chill and excessive shrinkage will result. If you know that your iron is all right before melting and have trouble with your castings, what you want to do is increase the temperature in your cupola, and do not try to produce such phenomenal results of melting at a ratio of 17 to 1, as has been claimed, but never got with good results. From 8 or 10 to 1 is right. This same fact applies to the steel foundries, as they will try to reduce the cost of their irons in the cupola, trusting to their converters to bring the steel out all right.

XUM

JOURNAL OF THE

# American Foundrymen's Association.

# PROCEEDINGS.

VOL. IX. PART II.

# PROCEEDINGS OF THE FIFTH CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

## CHICAGO, ILL., JUNE 5, 6 AND 7, 1900.

The fifth convention of the American Foundrymen's Association was held at the Great Northern Hotel, in Chicago, the members and their friends enjoying the bracing lake breezes in the Palm Garden on the 17th floor. The president of the Chicago Foundrymen's Executive Committee called the meeting to order at 11 A. M., and in the course of his address of welcome Mr. W. A. Jones felicitated the Chicago Foundrymen on the successful culmination of the local effort to entertain the representatives of so great an American industry. He dwelt upon the difficulties the local Foundrymen were just on the point of recovering from having been handicapped by a series of strikes, commencing first with the machinists, next the molders, and finally with the core makers; the last unpleasantness being still in progress at the time. Mr. Jones extended a most hearty welcome to the visiting Foundrymen on behalf of the city of Chicago, and promised the individual help and co-operation of the members of the local committee to those of the guests who wished to become acquainted with the details of foundry life in the city. That this promise was faithfully carried out, can be vouched for by more than one of the visitors who availed themselves of the opportunity thus kindly presented.

Mr. Jones then introduced Dr. Howard S. Taylor, of the mayor's office, who addressed the Convention as follows:—

Mr. Chairman and Gentleman, I have just received a commission that amounts to a draft directing me to come to this meeting and in the place and name of his honor the mayor to extend to you a most hearty welcome to Chicago. From the brevity of the notice you can well understand that I am entirely at a loss as to a speech that would be instructive or even entertaining, yet your presence here, your organization, your business so intimately connected as it is with all of the material greatness of Chicago, and indeed of the large municipalities of

America and the world, opens up a topic wide enough for one, however inexpert, to say something at least that would not be altogether irrelevant.

We are in the iron age, and in Chicago we are considerably in it. As a matter of fact, we have to-day to begin building in this city by making an iron or steel attack upon the antipodes. We start toward China, down just how many feet I am not qualified to say; but, nevertheless, from the bottom to the top we have to apply to you and your art; and it is with a consciousness of our indebtedness in the past and likely to be largely increased in the future that we extend to you the freedom of the city.

We have ordered a segment of clear weather specially upon your account. We have completed our great drainage enterprise largely for the purpose that when you should get here upon this occasion our river, however offensive it may be to Joliet and the towns below it, should not offend you; and the other drawbacks incident to Chicago, our smoke and our noises, and the danger to life and limb in our congested districts, why, gentlemen, you have only to regard these things from the view of an optimist to admire them, for even if you were run over or stifled with smoke, you might in the moments of your convalescence dwell upon the fact that all of these things, the smoke and congestion, are simply testimonials to the great energy and enterprise of Chicago. They mean industry; they mean rush; they mean hurry; they mean business; they mean the motto, "I will."

But you doubtless will think of these things without any aid upon my part. I merely desire to say to you that there is abundance of entertainment in Chicago. Our great municipality opens its doors for you to-day, and you are free to go and come as best suits your convenience and pleasure. Once more, gentlemen, on behalf of his honor, the Mayor, and the great municipality of which he is the chief magistrate, I bid you a most hearty welcome.

After the applause had subsided, the President of the American Foundrymen's Association, Mr. Jos. S. Seaman, invited Mr. Bell, formerly President of the Association, to make a few remarks before proceeding with the regular business.

XUM

Mr. Bell then said the following:—

Mr. President, it is a rather unexpected duty that I am called upon to perform after the very elegant remarks of the gentleman who has welcomed us to Chicago. It certainly ought to be a pleasant one. We are certainly delighted with our entertainment and in the manner in which we have been received, and more than delighted when we look over the program and see the various entertainments that have been provided for us. We had expected a royal entertainment from Chicago, knowing their large-heartedness and their ability to do those things better probably than any other community in the West; but when we look around us and see what has been provided for our entertainment and our pleasure, we are more than gratified. Our expectations have been more than realized. We are in the midst of a great people, a people that have grown up and built a wonderful city within the life of a single individual. From a swamp-prairie, we see the finest city, with one exception, in the United States, finer than many of the old municipalities of the old world, with all the elements of happiness and comfort to man that could possibly be provided; with abundant means and abundant ability and abundant hospitality to gratify. No place, no people, could do more than this.

I, therefore, in behalf of your Association of the American Foundrymen, acknowledge our obligation to these good people, and trust that our meeting together will be pleasant, and that we will go away with still higher admiration for the great city on the lakes.

Mr. Bell's remarks were heartily applauded, and then the President read his annual address.

## PRESIDENT'S ADDRESS

Fellow Members of the American Foundrymen's Association.

In presenting the customary annual report in review of the Association's activity during the past year, I must first congratulate you all on the magnificent outlook for the iron industry here and abroad. That we should all be so busy at home, so that the question of leaving our interests for even the few days of this Convention becomes a serious one, is only one of the en-

couraging features of an industrial revival unparalleled in the history of this country.

While prices will not always remain so high as they now are, the indications are for a long-continued period of prosperity based upon moderate profits.

That the abnormal activity in the foundry trade has brought about serious clashes between the vested interests and those depending upon them is deplorable enough though unavoidable so long as human nature is constituted as we know it. The bitterness and brute violence formerly attending such disputes seems at last to have yielded to more peaceable and therefore more effective means of argument. Fortunately for our Association the contentions between capital and labor are far removed from its sphere of influence, and industrial education in its truest sense is the key note of our aim and object.

Looking over the field of foundry movements during the past year we see a notable effort made in modernizing equipment, especially in the new shops and the extensive additions to the old ones. It is not now a question of how much it costs, but how well will the outlay required pay. Consequently we can see hundreds of thousands of dollars spent this year where formerly the tenth part would have seemed excessive. This can have but one result: a preponderating tendency to specialization; foundries managed by men specially trained in the economies of manufacturing; the treatment of the labor problem along lines of the true political economy; and in fact a quiet revolution from the numerous "all around" jobbing foundries to vast specializing industrial plants.

In this connection I commend to your attention a proposal to be brought before you later on relative to the higher training of our future foundry managers. The time when the foundry will be recognized as an integral part of the vast metallurgical field where the best talents are required and appreciated is fast approaching, and the onward march of knowledge in things relating to the smelting of other metals so thoroughly exploited should be made to embrace the peculiar alloy of iron with carbon we have built up such an immense industry upon. May the "fittest" survive in bringing about this improvement.

While many foundries have been built during the year and

XUM

numerous other ones are now greatly enlarged, the most notable advance has been made in the field of malleable and steel castings. An imposing list of these enterprises, remarkable for their financial strength, shows that these particular branches of the foundry trade have felt an unmistakable impetus of late.

What the future will bring us is hard to predict. The excessive demand caused by the actual needs of a country starved out by a long period of financial depression may hold out just long enough to present a solution to the threatening aspect of great industrial combinations. Perhaps this solution will be simple enough when fierce competition once more reigns supreme—but time alone can tell.

You will receive reports from our two special committees, each showing a fair measure of progress in spite of the enormous strains the individual members have been under all this time. The standard drillings of the Association as check samples are now recognized everywhere as authoritative, and the work of testing the various kinds of cast iron which is progressing quietly has attracted world-wide attention in showing the enormous possibilities and adaptations our various products are fitted for in the commercial economies of national existence.

I am specially pleased to report that my suggestion regarding closer union between the local associations and the American Foundrymen's Association has been materially aided by the simultaneous reading of papers by all foundrymen interested in foundry progress, and would recommend to you a still closer relationship of the "local" with the "American," so that a member of the former becomes ipse facto a member of the latter, and may enjoy all its rights and privileges. If you so choose to act, a committee might find profitable study during the year and report a plan for discussion and possible ratification at the coming convention in 1901.

Of the internal affairs of this Association, I can tell you nothing that is not contained in the report of your secretary, and in closing my own address, I can only express the heartfelt wish that success and prosperity attend each and every member of this splendid Association at all times.

Mr. Seaman's address was very favorably received, and the recommendations concerning the welfare of the Association

thoroughly discussed during the Convention by the individual members; the subsequent proceedings bringing some tangible results. The Secretary, Mr. John A. Penton, then read his report.

## THE SECRETARY'S REPORT.

During the year that has passed since our Association last met, the foundrymen of America have been busier than at any period during the past decade, and from an industry that suffered as much if not more than any other on the continent as a result of the previous year's depression, it found itself suddenly participating in the revival that was as great as it was in some respects extraordinary.

While this activity, however, had all the appearances of bringing with it a proportionate amount of prosperity, yet it is well known that in proportion to the increased cost of raw material, fuel, labor, etc., the profits of the foundryman per ton have not been in harmony with anticipations that had been formed.

In addition to this, and to add to the serious uncertainty of the situation at this time, we find everywhere a large falling off in the volume of business, and a still much more noticeable lessening of inquiries and decrease in the amount of new business offering.

While as yet the Agricultural and Malleable interests have suffered the most, there are not wanting signs of a lull in other lines of the foundry business that may, during the balance of this year, very visibly affect the volume of production.

While it is true that iron, all things considered, has held its own very wonderfully, and that stocks on hands have not increased materially, there is no doubt that a gradual shading of prices has been inaugurated that bids fair to continue for some time to come.

It is conceded by all producers, as well as consumers, that this is inevitable—the only question being the speed with which the market is likely to decline, and this will probably be determined by causes that can neither be foreseen nor controlled.

The far-seeing foundryman who realizes the unsubstantial character of anything that savors of a "boom," never fails, how-

XUM

ever, to continue his efforts to reduce cost by a close study of every condition that affects his production, and this accounts for the fact that there has never been a period in our history when as much attention has been given to economical appliances and methods for the rapid, efficient and cheaper production of castings of every kind.

The construction of patterns and core-boxes, both large and small, especially when much duplication is possible, is now closely scrutinized and carefully studied to such an extent that the improvements being made from year to year in this department alone requires constant attention if one desires to keep abreast of the times.

The many changes, some of them of course of a minor nature, that are being constantly made in follow-boards, clamps, flasks, and similar devices, amount to a great deal in the aggregate, and it is surprising to note what ingenuity can accomplish even in these respects, and the great difference that exists between founders doing oftentimes the same kind of work.

But the greatest revolution of all has been made by the Molding Machine. No one would have been warranted in predicting five years ago what would have been possible of accomplishment in 1900 in this respect. It is true, of course, that in a vague sort of way an optimistic foundryman would say great things were likely to be consummated, but there were no exact data upon which to base any conclusion other than a general feeling that we have been drifting "machine-wards."

The growth of the machine in popular favor, and the universal appreciation of its adaptability to a wide range of work has been most remarkable, and every day brings new converts to the already large army of believers in its increasing utility.

Patterns that it was thought a few years ago must always be molded by hand are now successfully made on some of the many types of machines that are on the market, and foundrymen who have, with a conservatism worthy of a better cause, been clinging tenaciously to old methods, have been compelled to see the splendid results their own competitors on similar kinds of work have been securing, and are beginning to feel the pressure that the machine exerts as an economizer and competitor.

Just where the line must be drawn between the possible and the impossible in this respect is hard to say, but is it not fair to assume that the thought the advent of the machine has inspired towards systematizing, may permeate the manufacture of castings of a larger size, and result to the benefit of the advanced foundryman in that line, also by an improvement in some method or other?

The machine has brought strongly to the front the fact that there is a factor that must be reckoned with in the management of the foundry which does not view with favor its rapid introduction, viz.: Labor, and Labor Organizations.

The Molder, or his Union, have placed themselves on record as not being opposed to the machine, but on the contrary are so much in favor of it that they are inclined to insist upon its control being put in their hands to the extent that none but Union men should be employed to operate it.

The irony of this is, of course, self-evident, and no one, not even the Union advocates of that policy are deceived as to what it means, viz.: "restricted output."

It is a very grave question as to whether or not the molder is so seriously handicapped by education, environment and association in the efforts to bring out the machine's best possibilities.

If he is a good molder, he will not care to work upon a machine whose operation is only manual labor of a severe kind. He will not be as interested in his work as in the production of a mold that requires from him a degree of artistic skill, and as a result of his having had inoculated into his system a sort of a reverence for the unwritten law of the "set day's work," he lacks the interest that is taken by the laborer to whom the operation is never other than that of laboring, who makes no unnecessary steps or needless moves, and with whom the only law that regulates or controls his output is his own efficiency.

Instances are plenty where the introduction of the machine has been opposed unless a union man was selected to operate it, and as this meant no advantage to the proprietors, the machine is, of course, of no value, and that proprietor is not permitted to produce the castings he requires in the way he may select, or as cheaply perhaps as his competitor not hampered with such restrictions.

XUM

There are, as a result of this condition, several consequences which may admit of reference here.

In the first place, the real or fancied antagonism of the molder to the machine has only served to stimulate the activities of inventors, machine producers and foundry proprietors, and it is possible that the machine may have received in some degree an impetus from this source.

In the second place, the fact that it is antagonized and the fear that it may be antagonized, may prevent temporarily its introduction or more general use, but this very antagonism must operate as a sort of stimulus which sooner or later must inevitably result in the introduction and operation of the machine, or in any other contrivance that will serve eventually as a cost-reducer.

It has been so from the first, when machines of any kind were opposed, and always will be.

In the line of new foundry structures, and their suitability for the particular class of work for which they are designed, their location, etc., more and more is being done every day, and the number of plants in existence that might be called model in every respect are steadily on the increase.

Not only that, but the improvements that are being constantly made in such items as cranes, ladles, core-ovens, annealing ovens, conveyers, trucks, etc., and their still more general adoption, are all evidence that the foundryman is thinking and studying, and that in the near future it will be a difficult matter to remain in the business successfully unless close attention is given to every detail in these respects.

Then we have those who have given up much of their valuable time to the study of iron and its use, and to whom the foundry world must always owe a debt of gratitude for their unselfish labor.

It must be conceded that relatively speaking and in proportion to the interests and number of men involved, that labor troubles have not been as frequent in the foundry or iron business the past season as they have in other lines, and while it may be too early to offer any predictions, yet it is hoped, and I am sure all will join me in the desire that such arrangements may yet be perfected between foundry employes and employers as

will for all time bring about more close and harmonious relations, and set a precedent for employers in other lines to follow.

It is pleasing to note that the interest in the American Foundrymen's Association seems to be steadily maintained, and that deducting resignations, we have had, up to date, a net gain in membership of thirty-one during the past year.

The receipts during the year, including the balance on hand a year ago, amount to $2,135; disbursements, $1,901.76; leaving a balance on hand of $233.24.

The outstanding indebtedness to May 1 amounts to $562.14, while there is owing to the Association in dues from the members, $750 that may be regarded as certain to be paid.

Your secretary regrets to say that our highly esteemed friend and treasurer, Mr. Howard Evans, has been in very poor health the past year, and this will again prevent him from being with us this year, but he feels that when another convention rolls around, he may again have the pleasure of meeting with the Association that he did so much to organize, and for which he has labored so earnestly.

The president then stated that the treasurer, Mr. Howard Evans, had sent in no report, and suggested that this matter be again taken up before adjournment, and an auditing committee appointed, in this respect meeting the wishes of the absent treasurer.

Mr. Roberts, of the Entertainment Committee, now made a number of announcements in regard to the program of the day. Following this the president read a telegram received from Mr. Evans, of Philadelphia. On motion of Mr. W. A. Jones, a committee consisting of Messrs. Jones, Penton and Moldenke was appointed to send a suitable reply to Mr. Evans, on behalf of the members of the Association in Convention. This was duly carried out during the morning session.

As it was too early to adjourn, the reports from the standing committees were called for. The Chairman of the Committee on Standardizing the Testing of Cast Iron, read the following:—

XUM

## REPORT OF THE COMMITTEE ON STANDARDIZING THE TESTING OF CAST IRON.

GENTLEMEN—Your committee begs to report the further progress made in its work during the interval of time between conventions. The phenomenal activity of the trade has naturally been felt very keenly by us all, so much so that it took three months of unremitting effort on the part of one member to cast the two partial sets of bars tested during the year. Another member of the committee, who is trying to give us two other sets of test bars, has vainly been endeavoring to do so for the greater part of the year. While this state of affairs is rather discouraging to the testing industry, yet it must not be forgotten that the years of prosperity are not always those of progress. The lean years give more leisure for investigation and bring with them a greater incentive to experiment and improvement.

We can therefore give only the records accompanying this report and call attention to the recent publication of a special study on the transverse test. The series of special tests promised us by our friends last year have finally failed us, but will be taken up in order just the same, as time permits. On the other hand, the work, as far as it has gone, has attracted wide attention in Europe as well as in this country, the hearty support and kindly criticisms of many investigators forming a gratifying acknowledgment of the sincerity of purpose on our part. We wish to record the kindly services rendered the committee by the Pittsburg Testing Laboratory and the Riehle Bros.' Testing Machine Co., the former for their ready help on the chemical and physical work connected with the smaller sizes of the test bars, and the latter for the tests made on the largest sections, which ran far beyond the range of ordinary work.

We are glad to note that impact testing is securing special attention at the hands of several testing experts. One small set of bars have been prepared by us for Prof. Hatt, of Purdue University, which he will test in conjunction with steel and iron specimens on his new machine for testing by impact bars which are at the same time under tensile or compressive strain.

The American Foundrymen's Association has been specially complimented for its high standing on questions relating to cast iron by the appointment of one member of your committee on the special work of the American Section of the "International Association for Testing Materials" on the investigation of the magnetic properties of iron and steel used for electrical purposes. The work of studying our foundry product for commercial uses is just beginning and the American Foundrymen's Association is certainly destined to take a most active part in it.

It is to be regretted that the past year's results are so meager. There has not even been a sufficient amount of time available to elaborate the results already obtained. We feel, however, that you will readily pardon us, as you are all in exactly the same position and are assuredly happy to continue so for as long a time as possible. Respectfully submitted,

THOS. D. WEST,
JAS. S. STIRLING,
JOS. S. SEAMAN,
JOS. S. MCDONALD,
RICHARD MOLDENKE, Chairman.

The tabulated results accompanying the report will be found among the papers read at the Convention, in another part of this volume. The President called attention to the importance of the work which was then briefly discussed. On motion of Mr. A. W. Slocum a vote of thanks was tendered Dr. Moldenke. The President then called for the report of the Committee on the Asssociation's Standardizing Bureau. Mr. Thos. D. West, the Chairman, reported as follows:

## AMERICAN FOUNDRYMEN'S ASSOCIATION STANDARDIZING BUREAU.

In rendering a report of the Bureau's progress up to May 19, 1900, to this convention, the committee would call attention to the subjoined list of subscribers, which shows that the number of laboratories which have adopted the Association's standardized

drillings has increased to 149. Two of these laboratories are in Germany, one in England, two in Australia, one in Nova Scotia, three in Canada and one hundred and forty in the United States. The following statement shows that all indebtedness has been paid, leaving a balance of $245.78 in the bank, outstanding collections $39.64, and 196 pounds of drillings still on hand.

| | |
|---|---|
| Total expenses to May 19, 1900 | $519.39 |
| Collections for drillings to date | 765.17 |
| Bills receivable | 39.64 |
| Cash in bank | 245.78 |
| Amount of standardized drillings on hand | 196 |

It has taken zealous and persistent labor on the part of the committee to achieve the above result. In starting this work, about two years ago, it took personal solicitation to secure orders and get laboratories interested in the work. Many queer ideas and much prejudice had to be met and overcome before some chemists would approve the adoption of the Association's standards. However, it is a pleasure to state that those who have used these standards are heartily praising their excellence and value.

A great obstacle to be overcome in introducing these standards was the doubtful practice of different chemists making their own standards. It had to be shown that such procedure failed signally in obtaining a uniform set of standards for universal exchange. To demonstrate this, Mr. West prepared special samples of drillings from pig iron and sent them to twenty chemists for analysis, with a view of learning how close they would agree. It will be remembered that at the time of the publication of the results obtained by Mr. West, in The Iron Trade Review, April 14, 1898, some critics claimed that the great variation of the analyses then published, and given in Table 1, was wholly due to the imperfection of the samples. So many chemists believed this to be the case that it caused Mr. Edmund E. Johnson, then chemist of the Ashland Iron and Steel Co., to get up what he thought a perfect sample, as an offset to Mr. West's supposedly imperfect one, to distribute to chemists for a comparison. Samples of Mr.

Johnson's drillings were sent to fifty chemists, and brought results, published in The Iron Age, May 18, 1899, that were just as variable as those obtained by Mr. West, as can be seen by a study of Table 1. These variations prove more than any other thing can the value of standards created by our ablest experts and distributed by one central agency. This plan is being carried out by the American Foundrymen's Association Standardizing Bureau, and that its work is being more and more recognized is proven by the fact that 149 of our best laboratories are now using the Association's standards.

**TABLE SHOWING GREATEST VARIATION IN ANALYSES ON ONE SAMPLE IN CHECKING DRILLINGS.**

| | Sil. | Sul. | Phos. | Mang. | C.C. | G.C. | T.C. |
|---|---|---|---|---|---|---|---|
| Mr. Johnson's variation... | .19 | .028 | .029 | .19 | .34 | .82 | .48 |
| Mr. West's variation..... | .21 | .015 | .031 | .23 | .59 | .77 | 1.09 |

The committee has published the above table with a view of emphasizing the practical value of its work and as an argument for continuing the good being done until all laboratories come to recognize the necessity of possessing the standards distributed by the Association's Bureau. From the progress being made, it looks as though the day was not far distant when this will have been accomplished.

The variations shown in Table 1 are not so much due to the character of either sample, but rather to the lack of tangible means to detect errors in the results. This, unfortunately, is still a weak point in the chemist's profession, and, instead of feeling aggrieved at the great disagreement of results in either Mr. Johnson's or Mr. West's report, seen in Table 1, efforts should be made to remove all objectionable conditions so that greater uniformity in analyses may result. This the American Foundrymen's Association Standardizing Bureau is now helping to do.

Respectfully submitted,

THOS. D. WEST, Sharpsville, Pa.,
RICHARD MOLDENKE, Pittsburg, Pa.,
JAMES SCOTT, Pittsburg, Pa.,
P. W. GATES, Chicago, Ill.,
E. H. PUTNAM, Moline, Ill.

XUM

The memoranda accompanying this report will be found among the papers read at the Convention, in another part of the volume.

In discussing the results of this work Mr. Penton called attention to the great labor involved in carrying out the plans laid out by the Committees. The results had been gathered from investigations extending over years, and the importance and value of such expert work could not be readily judged at the present time. The world was beginning to appreciate this line of investigation, and the American Foundrymen would reap the benefit and honor coming therefrom.

Mr. Jones and Mr. Stirling added some complimentary remarks, and on motion a vote of thanks was tendered Mr. West for his work in connection with the Standardizing Bureau of the Association.

The Convention then took a recess until two o'clock in the afternoon.

## Afternoon Session, June 5.

The President called the meeting to order, and then announced the following as the Committee on Nominations: C. J. Wolff, for Chicago; James T. Stirling, for Philadelphia; Wm. Yagle, for Pittsburg; James Lanigan, for New England; Harry Bell, J. P. Golden and E. H. Walker, at large.

The first paper taken up was that of Dr. Edward Kirk, of Philadelphia, entitled, "The Training of Foundry Chemists," and in his absence read by Mr. Penton. This paper, as well as all the others, will be found in another part of this volume. The discussions are also given separately, so that the authors of the papers may be enabled to make a comprehensive summary later on.

Mr. West followed Dr. Kirk's paper with a written discussion thereon. He then read his own paper, entitled, "Training Students in the Principles of Scientific and Commercial Founding."

Then followed what was universally admitted to have been the most interesting and brilliant discussion in the history of the American Foundrymen's Association. In fact, the desire to have more of such practical discussions at future Conventions

XUM

was voiced as the unanimous opinion of those who were present at the time. The detailed report will be found further on, and includes a paper by Prof. R. H. Richards, of the Massachusetts Institute of Technology, which arrived after the subject matter had been disposed of. At the close of the discussion Dr. Moldenke, as chairman of a special committee appointed by the Pittsburg Foundrymen, read a memorial which had been endorsed by the Foundrymen's Associations of Philadelphia, New England and Chicago:

## MEMORIAL.

The undersigned, a committee appointed by the Pittsburg Foundrymen's Association, would respectfully memorialize the American Foundrymen's Association on behalf of the careful training of our coming foundry superintendents and managers for the duties they will be called upon to perform.

When in a recent meeting of an association of foundrymen it was resolved "that the industry had arrived at a point where there is a demand for managers properly trained in the principles of scientific and commercial founding, and that a representative body such as the American Foundrymen's Association be requested to draw the attention of institutions of learning in the country to this fact, and urge them to take the necessary steps to supply the demand," the case was stated in a very plain manner. We are indeed drawing near to that point when so much is expected of a foreman, chemist, superintendent or manager, that he cannot hope to obtain all the necessary knowledge by the ordinary process of growing up with his work and learning to do what his predecessors were wont to.

The introduction of chilled pig irons, the deceptions arising from fractures of high pressure made irons, the education of the buying public in matters relating to what castings should be, the systematizing and close calculations necessary to produce successfully and finally the very necessary utilization of irons and scrap formerly considered out of the question, have combined to give the internal foundry economies quite a different aspect when compared with the conditions prevailing a decade ago.

What will be the problems in founding we shall be called upon to overcome 20 years from now? Only a technical edu-

XUM

cation in the broadest sense when combined with a thorough business training will fit the man who can profit by these to look forward into the uncertain future with equanimity. Let us survey the wonderful resources of this expanding country of ours, and note the history of each and every metallic product. We will then see that slowly but surely scientific methods introduced by trained metallurgists are improving, if not altogether replacing, the early processes. We do not now hear of losses of heavy percentages of metal in slags, and where would nine-tenths of the paying properties be to-day were it not for methods based on the recovery of such minute quantities of metal that old dump heaps may be said to be profitable mines? So we will find that science has changed the metallurgy of gold, silver, copper, lead, iron, etc., so radically that we are to-day dealing with the raw metals in such enormous quantities and so uniformly excellent that a splendid series of industries has been built up to use them.

When we realize that the production and manufacture of nearly everything metallic except cast iron is now practically in the hands of specially trained men, and that the foundry is beginning to feel this influence also, is it not wisdom to take advantage of existing knowledge and try to increase it for our benefit? We all expect our sons to follow our footsteps. When we send them to the universities to acquire the faculty of sound thinking, or to our great technical schools for a fund of knowledge unequalled in its variety and usefulness for daily life, why should they not begin to lay a good foundation for their future careers? The benefit of a sound technical training to a young man who must some day step into the active management of an industrial enterprise is incalculable. It is the object of this memorial to urge that a young man who is fitting himself for a foundry career be given an opportunity to acquire the principles underlying the successful production of foundry products before he actually enters routine work. He will thus avoid much costly experimenting when time is precious.

How may institutions of learning attack the problem? Few of them have a corps of instructors sufficiently in touch with the foundry to meet the requirements. The most practical way would seem to be the enlargement of the regular course in

metallurgy to embrace special instruction in foundry practice, supplemented by summer work and instruction in noted shops. A course in foundry practice could be given by men experienced in this branch of metallurgy, who could also outline a series of experiments for purposes of instruction in collaboration with the regular professors where an institution possesses a small experimental foundry plant.

It is quite certain that many of our institutions of learning will be glad to take up this question if so representative a body as the American Foundrymen's Association sees fit to recommend to them the establishment of courses to teach the principles of the art of founding. Our American universities have always risen to the occasion, and will not fail us in this instance.

We, the undersigned, on behalf of our Association, would therefore recommend the following:

*Resolved,* That the American Foundrymen's Association would welcome a course of training in the principles and practice of founding to be established by our institutions of learning, whereby those of their students who expect to devote themselves to this line of work may be made more valuable to the industry.

Respectfully submitted,

WM. YAGLE,
THOS. D. WEST,
S. M. ROGERS,
F. R. ZIMMERS,
RICHARD MOLDENKE, Chairman.

On motion the resolution prepared was unanimously adopted and the Secretary of the Association instructed to carry out the provisions thereof.

The following papers were then read by the Secretary: "The Mixing and Melting of Iron for Hydraulic Work," by Mr. R. P. Cunningham, of Holyoke, Mass.

"Crystallization of Metals," by Mr. Edward B. Gilmour, of Milwaukee, Wis.

After a short discussion, given in another part of these proceedings, the Convention adjourned for the day.

XUM

Wednesday, June 6.

The day was given over to sight-seeing, a fair idea of Chicago as an industrial center being obtained in this way. The steamer "Soo City" took the members and their friends out to South Chicago, landing at the dock of the Illinois Steel Company, on the Calumet River. The peculiar method of unloading the ore from whaleboats, by means of long arms let down into the hold, the raising and dumping of the buckets into cars, came in for considerable attention, for the arrangements made every minute count. Mr. C. H. McCullough led the party through the mills, when those who had been in Pittsburg the year before could make some interesting comparisons of the open-hearth and converter practice in use in the two locations. Further up Calumet River the furnaces of the Iroquois Iron Co., of Roger Brown & Co., were inspected. The new furnace going up was especially interesting for its large size and solid foundation. When finished the capacity of the plant will be 180,000 tons of pig iron per year. The steamer next stopped at the yard of the Chicago Ship Building Co., where several of the largest lake vessels were in process of completion. The large, well-lighted, high machine shop came in for much attention, especially as the experiment of painting all the machine beds and frames in white to inculcate habits of neatness and precision, seemed to be a great success.

During the trip tickets for various theatres were distributed, and in the evening a number of parties were formed to enjoy the entertainment thus kindly offered more thoroughly. Afterwards "the only," J. D. Smith, of Cincinnati, presided over the more spectacular "smoker" of the Plumbago Club, where interested students of human nature, with foundry leanings, besides thoroughly enjoying themselves, could make critical comparisons between Viola Allen's "Christian" and the "vaudeville" of North Clark st., Chicago.

Thursday, June 7.

President J. S. Seaman called the Convention to order at 11 A. M. The following papers were read by title and distributed among the members present:

Foundry Management, by Mr. Jos. A. Murphy, Elizabethport, N. J.

What are Inmprovements? by Mr. P. R. Ramp, Aurora, Ill.

Foundry Flasks, by Mr. Eli H. Pierce, Baton Rouge, La.

The Real Fuel Ratio, by Mr. L. C. Jewett, North Attleboro, Mass.

The President now called for suggestions as to the next meeting place for the Convention, so that the Executive Committee, who have the matter in hand, could act in accordance with the expressed wishes of the members of the Convention. Mr. Bell suggested that in the absence of an invitation from the East, Cleveland or Buffalo might be selected. Dr. Moldenke mentioned the fact that with all meetings there came a time sooner or later when more weight had to be placed upon the business than on the entertainment of the Convention, and consequently a location such as Atlantic City in the East or Lookout Mountain in the South, where there would be no work thrown upon a local entertaining committee might afford more opportunity to take up the serious side of our gatherings. Mr. Bell endorsed the spirit of this suggestion, and hoped the Executive Committee would take this point into consideration.

It was then suggested that in view of the Pan-American Exposition, to be held in Buffalo next year, the Convention should go there, as most of the members would wish to see this anyhow.

Mr. Bell now brought up the question of the Journal, and suggested that its size be limited. Mr. S. J. Flagg, Jr., stated that the feature which gave a review of all the foundry literature, should by all means be retained, and, if anything, extended. He found the Journal a valuable work of reference in just this line. The President now reviewed the action of the Association in regard to publications during the year, and explained the usefulness of the central distributing agency for foundry literature, which enabled the local Associations to have the same paper read before them on the same day.

The President now called for further suggestions, whereupon Mr. Willis Brown moved that a committee of five be appointed by the chair, to revise the Constitution and By-Laws of the American Foundrymen's Association; the Committee to

XUM

report at the next Convention. Motion carried, and Messrs. Brown, Keep, Jones, Bell and Moldenke appointed.

The Nominating Committee now brought in their report: First stating that Mr. Penton, owing to his connection with other organizations and press of private business, had found it impossible to allow the use of his name for the secretaryship. After some discussion by the members, the secretary was instructed to cast one ballot for the entire list of nominees as reported by the Committee.

The officers elected are as follows:

President, W. A. Jones, W. A. Jones Foundry & Machine Works, Chicago, Ills.

Secretary, Dr. Richard Moldenke, Pennsylvania Malleable Co., Pittsburg, Pa.

Treasurer, Howard Evans, J. W. Paxson Co., Philadelphia, Pa.

New England States: Geo. B. Buckingham, Arcade Malleable Iron Works, Worcester, Mass.

Middle States: Wm. Yagle, Wm. Yagle & Co., Ltd., Pittsburg, Pa.

Southern States: J. P. Golden, Golden's Foundry & Machine Co., Columbus, Ga.

Central Western States: John A. Penton, "The Foundry," Detroit, Mich.

Northwestern States: Wm. Ferguson, Ferguson Foundry Company, Chicago, Ill.

Southwestern States: W. S. Moscher, Moscher Mfg. Company, Dallas, Tex.

Pacific States: R. Chartrey, Joshua Hendy Machine Works, San Francisco, Cal.

Canada: T. J. Best, Warden, King & Son, Montreal, P. Q.

Mr. J. S. Seaman, in resigning the chair to the newly elected president, spoke of the high honor conferred upon him by the Association a year ago, and wished for the continuance of harmony and prosperity in the body, as it always had been heretofore.

Mr. Jones then responded suitably, and promised his best efforts to advance the interests of the Association, asking for the hearty co-operation of its members.

XUM

Mr. Penton explained his inability to undertake the duties of the secretaryship again, more fully, and promised every possible help to the new incumbent of the office. Dr. Moldenke in returning his thanks for the great honor bestowed upon him at the hands of his fellow members, also expressed his gratitude in having the personal help of Mr. Penton.

On motion of Mr. Brown, the retiring officers of the Association received a hearty vote of thanks and an extraordinary expression especially directed to the retiring secretary.

On motion of Dr. Moldenke, Mr. J. S. Seaman was made an honorary member of the Association, for which action he returned his heartfelt thanks. On motion of Mr. Bell, the thanks of the Convention was returned to the Chicago foundrymen, and the local committee especially, for their splendid efforts and bounteous entertainment. On Mr. Stirling's motion, the above action was extended to the Illinois Steel Company, the Chicago Ship Building Company, and the Iroquois Furnace Company.

Mr. Penton, in a short address, very feelingly made official announcement of the recent death of a most valued officer and member of the Asssociation, Mr. C. A. Bauer, of Springfield, Ohio. He said:

"Looking over a very large acquaintance of my own, consisting of foundrymen in almost every State, I think no one will feel that I am taking unpardonable liberty in saying that he was my dearest friend, even in an audience where I have so many, and as a representative of your Association, invited your secretary, as representing your Association only, to serve as one of the pall-bears at his funeral. Other Associations of which Mr. Bauer was a member, feeling keenly the loss by his death, and realizing that the engineering, mechanical and scientific profession had suddenly became bereaved and lost one of its brightest members, have all at various times at their meetings adopted resolutions, in many cases presented to his family, expressing the regret that all felt at his untimely end.

Mr. Bauer's achievements as a foundryman were very well known to many persons, and the fact that his foundry was a successful one, and the fact that he gave so much time and attention to the scientific study of the foundry business, has made his town a Mecca for visiting foundrymen and those seeking

XUM

information regarding the advanced ideas in foundry methods which he so strongly advocated during his life."

On motion of Mr. Penton, a committee of five, consisting of the president as chairman, the three ex-presidents, and Mr. Penton as the other members, were appointed to draw up a set of resolutions to be presented to the family of our late vice-president.

The new president, Mr. W. A. Jones, appointed Mr. J. S. Seaman and Mr. W. Yagle, both of Pittsburg, as auditors of the finances of the Association.

With this the Convention adjourned.

In the afternoon the visitors took the A. T. & S. F. train along the Drainage Canal of the sanitary district of Chicago. Stops were made wherever anything of special interest was to be seen. At Lockport the waters of the canal empty into the Illinois River, and flow eventually into the Gulf of Mexico. Lunch was served on the train during the trip.

The evening was spent agreeably in the Palm Garden of the Great Northern Hotel. A fine program of excellent vaudeville was provided, and enjoyed by the largest assemblage of members and their friends during the whole Convention.

A number of visiting foundrymen remained in the city for several days after the Convention, to study special conditions in the foundry business as seen in Chicago.

The whole Convention will be voted a splendid success, and remembered for a long while to come.

## The Exhibits.

There were a number of very interesting exhibits on the 16th floor of the Great Northern Hotel. The Tabor Mfg. Co., of Elizabeth, N. J., had one of its new vibrator molding machines on exhibition, as well as a number of difficult castings made on it.

Brown Bro. Mfg. Co., of Chicago, Ill., showed the Hammer Core machine in actual operation, making a line of excellent stock cores up to 1½ inches diameter and perfectly vented.

The Carborundum Co., of Niagara Falls, N. Y., had a very attractive line of their products to show to the members and visitors. The resplendent crystals of the silicon carbide known as carborundum were very beautiful, and form an abrasive of no mean value.

The Sterling Emery Wheel Company, of Tiffin, O., also showed a fine line of emery and corundum wheels and grinding machinery.

The Eagle Emery & Corundum Wheel Co., of Chicago, displayed a number of excellent samples of their products.

The Garden City Sand Co. exhibited a fine line of special fire brick, molding sands, and facings of various kinds.

The S. Obermayer Co. had a lot of supplies in the foundry line on exhibition in the hall, as well as a "dark secret" to illuminate in their headquarters.

The J. D. Smith Foundry Supply Co. kept open house in their parlor, and incidently exhibited various specialties.

The exhibit of A. Leschen & Sons Rope Co., of St. Louis, was especially noteworthy, and was a fine display of wire and other ropes of all kinds, especially their patent flattened strand wire rope, etc.

## DISCUSSION ON THE QUESTION OF TRAINED METALLURGISTS IN THE FOUNDRY.

**To accompany the papers of Dr. Kirk, Mr. West, and Prof. Richards.**

Mr. Thos. D. West: The paper by Dr. Edward Kirk is in the line of recent publications from his pen advocating the training of chemists to assume the responsibility of mixing and melting of iron. The Doctor claims that foundrymen have proven unable to grasp the art of working by analysis, and for this reason the chemist should be trained to assume the responsibility. I wish to say that the Doctor is slightly in error herein, that the advancement which has been made in working by analysis in making mixtures of iron is very largely to be credited to molder foundrymen. The only work in existence which will permit anyone to make a success of working by analyses to make mixtures, who will take the time to study this advancement was written by a molder foundryman, and not a chemist. This is proper, for the knowledge necessary to fit one to be competent to assume the responsibility of mixing and melting of iron by analysis can only come from actual experience in all the work pertaining to the making of good castings, embracing that of the man who constructs the molds, the cupola tender, and the one that makes the iron mixture.

XUM

It is true that there are foundrymen who have failed to keep step with the progress of working by analysis. This is no evidence that it would be best to train chemists to be wholly responsible for the results of mixtures. It is but a few years since that the discovery was made that the fracture of pig iron was deceptive, and that it was best to be guided by analysis. We cannot expect that such a radical change in systems of making mixtures, demanding the abolishment of past methods and calling for study and research, can be inaugurated the country over in a year or two. Dr. Kirk would lead us to think that few, if any, founders had made a success of working by analysis, when, in fact, it is safe to say that about one-third of our foundries are at the present time successfully making mixtures by analysis, guided by foundrymen and not chemists, as was ably proven something over a year ago by Dr. W. B. Phillips, of Pittsburg.

If it was for the trade's best interest that chemists should be trained to be wholly responsible for results in making mixtures, I would not oppose it. Having worked steadily for the past thirty-eight years in all branches of molding, and in that time made almost all kinds of mixtures, and melted in almost all kinds of cupolas, I know from actual experience on the floor and as manager, that the general manager or president of a foundry who can hold one man responsible for all its manifold workings, will be operating with the greatest internal harmony and economy of manufacture.

One objection in dividing the responsibility for final results in making castings, lies in the fact that a molder or foreman can by design, ignorance or carelessness, make castings possessing varying qualities from the same patterns, and poured from the same ladle of iron.

To locate the responsibility for such varying results throughout a shop's "heat," when same mixture had been used would, to say nothing about the losses incurred, be very embarrassing to a general manager or president of a company who recognized the importance of maintaining internal harmony.

Another objection in dividing responsibility for results in castings, lies in the fact that such procedure would unfit men to be masters of founding, and decreases their ability to comprehend its difficulties and the skill required. It would cause many

XUM

to think that anyone having a few dollars to start a foundry could operate it successfully. As an illustration of the evils resulting from the inability to comprehend the difficulties involved and skill required in founding, I will cite a case which occurred recently not far from our foundry, and others can, no doubt, cite similar instances of doing an injury to the trade. This particular case was that of a blast furnace chemist renting a foundry in the vicinity of his laboratory, and hiring a farmer, a relation of his, to manage his foundry. This chemist evidently thought that all the science of founding lay in the cupola, and understanding analyses to make mixtures of iron. He thought, with the assistance of his farmer relative, that they both could run the foundry and make money, without his leaving his regular occupation.

This "would-be" foundryman remained in business about six months, when he failed, having lost all his money and much of that belonging to those who had allowed him credit for fuel, iron, etc. If this man had done no other injury than loosing his own money and that of his creditors, it would not have been so deplorable, but his ignorance of the difficulties, and skill required in molding, to make castings caused him to make prices that took the work away from old, experienced and successful founders. The evils of such incompetent management can be readily discerned, being most grievous and deserving condemnation wherever found. To guard against this unintelligent competition, we should oppose any measures that tends to only partially educate men in the difficulties and skill required in founding, and the broader we can make such an education, the better for all concerned. There is much more that I could say on this point, but as there are other features in Doctor Kirk's paper which I wish to discuss, I shall pass on to that portion under the heading of "Silicon Basis." Under this heading the Doctor says, "and silicon has been increased to so great an extent that the quality of foundry iron has been greatly reduced, and the practical founder is no longer working for high silicon iron, but for an iron low in silicon or free from it that his castings may have strength and other desirable "properties" (which he fails to describe) "that are destroyed by silicon in cast iron." Further on he also says, "Many lines of castings, amounting to thousands

XUM

of tons yearly, have been lost to steel. Many more will be lost if something is not done to improve the quality of foundry irons." From the statement we would infer that silicon was a metalloid of recent introduction into iron that had proven a failure, and that foundrymen were seeking to have their irons free of all silicon. There never was an iron made suitable for general castings that was free of silicon, nor is such a thing practical, with the past and present methods of making iron. Then, again, every founder of experience in working by analysis knows that by varying the percentages of silicon, where all the other elements remain constant, that he can regulate the strength of his iron and make the weakest or strongest iron obtainable in any special brand. The above connected with the Doctor's illusion of steel replacing cast iron, would say that founders of to-day cannot make as strong castings as those produced in years gone by. The Doctor offers no proof to substantiate his statements. I will say that experienced founders of to-day who desire to do so can make as strong if not stronger castings than was produced in the past, and that this is well illustrated by the fact that car wheel makers, chill roll and ingot mold founders and others make castings to-day that meet far higher requirements in their physical qualities than they did in years gone by.

Dr. Kirk's reference to steel is no evidence of a degeneration in the strength of physical properties of cast iron. If steel castings had originated at the same time as cast iron, we would have found that the Doctor's supposed superiority of cast iron in the past would have had to give place to steel then as much as it does to-day. Steel is not used because of the degeneration of cast iron, but because it possesses peculiar physical qualities not to be found in cast iron, which make it best fitted to fulfill certain conditions, similarly as we find it necessary to use malleable or brass castings, etc., to take the place of cast iron. There will always be a good field for cast iron, and none need fear its going out of use, as alarmists would have us believe.

In urging what a chemist should be held responsible for the Doctor includes the selection of sands and facings. These are materials similar to iron which are also best left to the molder foundrymen's judgment, in taking responsibility for results. I doubt if the day will ever come when a man can decide by

analysis without seeing and feeling his molding sands (as can be done with irons), whether sands are suitable for the varying conditions required in making castings. The molder foundrymen want to see and handle his sands, and only by experience in actual founding can anyone tell the grades of sand best suited for different classes of castings. With blackings or facings, the only test is to use them.

It will be noticed that I have used the term moulder foundryman in this discussion. Some years back we rarely, if ever, had foundrymen who were not practical molders, able to make good castings from any pattern or sweeps that might enter their foundries, while to-day, we have about as many founders incapable of doing this as there are those who can, hence I have adopted the term "molder foundryman" to show the distinction.

The first paragraph of the Doctor's paper, under the head of "Silicon Basis," states that "The silicon basis system in foundry iron has enabled the founder to produce castings with a little more certainty as to the degree of hardness and softness, than by the fracture." The Doctor holds the position that there are men who can tell by the fracture of pig iron just what grade of iron it will give when remelted. I will close this discussion by saying that I could collect a variety of pig iron samples by the fracture of which neither the Doctor nor anyone else can correctly predict the grade of castings in regard to softness or hardness the samples would produce when remelted. I merely make this statement here in the hope it will result in a quicker termination of the belief still held by some that they can define the grade of pig iron by the appearance of its fracture.

Dr. Moldenke: Mr. West has given us such a lucid explanation of the whole matter that I think it is very difficult to add anything to it. I would like to see the cast iron that contains no silicon. I would like to see the cast steel that contains no silicon. I would like to see the molding sand that can be analyzed and tell just what it will do when it is fresh and after it has been used, with our present knowledge of the subject. It is a very difficult thing to discuss papers of this kind, the field is very broad, and I feel that Mr. West has given us so much upon it that I can add but little to it.

XUM

Mr. Bell: I agree very heartily with almost everything Mr. West has said; but there seems to be something lacking in all that has been said. I suppose there is no mechanical trade that is so entirely dependent upon the judgment of the operator as the foundry business. I think every foundryman who has had any experience practically in the management of a foundry will agree with me upon that point. You might just as well attempt to make an athlete from book learning as to make a practical founder from a mechanical education. There must something else go with it. I would not for a moment dispute the value of the chemist in a foundry. Unfortunately, in my day it was not available. We had to learn what we did learn about the foundry business from experience. We went through it from the foundation up; and whatever success has been obtained by old foundrymen has been by the exercise of that quality—good judgment, ability to decide questions practically from facts that have come within his observation. Now, I think a college education is a good thing. A college education is a good thing for the minister and for the lawyer and various other callings in life, and so it is valuable to the foundryman; but, your classic education is not going to made an attorney of anybody, nor is it going to make a good minister of anybody; it takes something more. That is what I am trying t get at; it lacks something more, and that "more" depends, first, upon the individual. He must have a genius for it—for the exercise of judgment upon a trade that is so largely dependent upon good judgment. Now, there are some young men—boys—coming up that you might educate in the highest branches and give them all the facilities, and they would never make a foundryman; they want to go by rule. "The books say so." I knew a Doctor once who was very highly educated in the books, but when it came to practical affairs he seemed to be a child, and he is a child to-day. He is still in his books. He is still in the alphabet. He knows what is in the books just as well as anybody does, and he knows it thoroughly, and can put his finger upon it, but when it comes to a practical case of sickness, he don't seem to be able to get all these things together that are necessary to success.

Now, I mean only this, that the practical foundryman is benefited by any learning that he can get together from books

XUM

and chemists and from every source, but all these things together without the genius of founding is vain and lost.

Dr. Moldenke: I fully endorse everything that Mr. Bell has said. It is greatly to the point. You take a good college man and put him in the foundry, and he will only have success if he has the genius to grasp it. I may feel a little flattered that I have succeeded a little bit. When I went into the foundry my employer told me he would give me five years to accomplish a certain result. I accomplished it in three, and have saved that foundry an enormous sum as a consequence. The point is this—more young men are coming forward every year. If under the old way it took ten or fifteen years to obtain experience in the founding, we want the young men to pass over half of this time by a proper education in foundry matters. It means time saved, and time is money. It is the young man of to-day who has got to push matters, and the chances are that our sons are the ones who will do it. We want to see our sons in the foundry some day, and what is better than to equip them as well as we can before they start.

We have to thank Dr. Kirk for bringing this matter up. The Pittsburg foundrymen have appointed a committee to bring it before this convention. I have it in the form of a memorial, and as soon as the discussion is completed, with your permission, I will read it. The memorial includes a resolution which, if adopted and carried out, will call public attention to this matter. This is a great field, and many young men will wish to take advantage of this fact and learn the principles of commercial founding.

Maj. McDowell: This has been an exceedingly interesting meeting to me. It seems to me that a practical way of getting at this is for every man here who has had any experience at all to give it, and out of the great amount of experience of each man a better way out is found. I commenced originally not as a foundryman at all, but drifted into it merely by accident. After getting there, however, I went to the bottom of it, and was not satisfied until I had a complete laboratory and a good chemist back of me. I then saw the great many questions that came up, and I presented to our foundrymen's association some papers on the value of metalloids with iron, and I proposed a series of

XUM

experiments to demonstrate what this metalloid or this metal in combination with iron would do—what kind of a casting it would make—what the value of it was—to establish some principles of the kind as you do in establishing standard test bars. Instead of buying iron as you do you would buy it intelligently, because you know the combinations of the different metals and metalloids, giving the qualities you want. The large works I went to were in New England—among the largest in the United States. They carried an immense stock of all kinds of iron. Experiments were made on the various lots of scrap iron, until we knew the value of the metalloids in the piles of iron. Back of this was the laboratory—this college-bred young man—who made a perfect analysis of the iron and understood it thoroughly. They were able to make a variety of castings from ⅛ of an inch thick upward. What you want to know is, what it takes to make a casting. You want to know that you have the material to make it and know what it is that makes it. Now it is utterly impossible to do that without a chemical analysis.

Mr. Lanigan, of Mass., inquired of Mr. McDowell as to how he classified mechanics in relation to molders, as to which class he considered superior.

Maj. McDowell expressed it as his opinion that the molder was superior to the mechanic—that founding was the foundation of mechanics.

Mr. F. B. Farnsworth, of New Haven, next addressed the convention. On the question of the education of young men for the business of foundrymen, he said that it was his observation that young men after receiving a college education for the purpose of fitting them to become good foundrymen were inclined to drift into other professions. The speaker referred to his son, who had been educated for this purpose, but after leaving school had followed other and more profitable pursuits. He said it was difficult to find men who had received a good schooling who were willing to pound sand.

Mr. Sadlier, of Springfield, O., in the course of some very interesting remarks, propounded a few questions for which he had not found satisfactory explanation during a life experience in foundry work. He brought out the fact that there were such pronounced differences in irons of the same composition that chemistry alone would not explain them.

The secretary would state here that both Mr. Sadlier's and Mr. Farnsworth's remarks were so interesting to the members present, and were delivered so fluently and rapidly, that the stenographer present must have paid more attention to them than to the records, for they failed to appear afterwards. This is all the more to be regretted, as the remarks of the two gentlemen were considered by all to have been the best expressions of the difficulties the practical foundryman meets with, and more of such talks are wanted at our conventions. The thanks of the members present were given to the speakers later on informally.

## DISCUSSION ON MR. GILMOUR'S PAPER ON "CRYSTALLIZATION OF METALS".

Mr. Bell: In the last paragraph of this paper the assertion is made, "if you want a stronger casting, pour the iron as dull as possible." That is a question that is debatable. There may be irons that act that way, but I am free to say that there are irons that will act quite differently. I have had opportunities, some years ago, to test that matter very effectively, and if a casting is poured reasonably hot, as hot as ordinary, it is stronger than if poured dull. It is a matter, in my judgment, that depends upon the character of the iron. This has been my experience that pouring irons hot—that they were stronger than those poured dull.

Mr. West: I would say upon this point that Mr. Bell is correct, when he said it depended upon the iron. It is regulated entirely by the combined carbon that we retain in the casting, and whether in retaining that combined carbon we overreach the limit.

XUM

XUM

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION, JUNE 13, 1900.

The meeting was held in the Hotel Lincoln, and reports of the proceedings at the Chicago convention received from Messrs. Seaman, Yagle and Moldenke. The action of the American Foundrymen's Association upon the memorial presented by the Pittsburg local association was very gratifying to the members, for it showed that the importance of the subject of trained metallurgists in the foundry was duly appreciated all over the country.

The paper of the evening was read by Mr. S. M. Rodgers, of the American Steel & Wire Co.'s Hainsworth Steel Works. A spirited discussion followed, and after voting the thanks of the Association to Mr. Rodgers the members adjourned to meet again on the first Wednesday of September.

### DISCUSSION ON MR. S. M. ROGERS' PAPER ON "CUPOLA PRACTICE IN BESSEMER STEEL WORKS."

This discussion was reported by Mr. A. O. Backert and published in The Iron Trade Review June 21. The statement of Mr. Rodgers that under favorable conditions it requires about 30,000 cubic feet of air, or about 2,400 pounds to melt one ton of iron, was considered in connection with the reference to the large amount of moisture in the atmosphere which renders the operation of the cupola very difficult, especially on a damp or rainy day. This resulted in a discussion of the effect of moisture in the atmosphere on the production of iron in the blast furnace. It was stated that under normal conditions with the temperature at 70 degrees Fahrenheit, 1,000 cubic feet of air, equal to 75 pounds, contains one pound of moisture and that each pound of moisture requires one additional pound of coke. Tests have proved that when the air is charged with moisture, from 200 to 300 more pounds of coke are required for producing one ton of iron than when the air is dry and comparatively little moisture is blown into the furnace. It was further stated that heating the air did not eliminate the moisture and that up to the present time no means

have been devised to take the surplus moisture out of the air. Tests made in the South showed that more coke is required there to reduce one ton of iron than at furnaces in the North. Furnaces in the Pittsburg district and in the valleys require on an average of from 100 to 200 pounds of coke more during damp or wet weather to reduce the charge than under very favorable conditions. In cupola practice these variation due to atmospheric conditions are also encountered. Experiments are now being made by chemists to reduce the amount of moisture in the air before entering the stoves for blast furnaces, and it was stated further that the same principle as that upon which liquid air is produced is forming the basis for the series of experiments.

The statement in Mr. Rodgers's paper regarding perfect combustion and the resulting carbonic acid gas ($Co_2$) was next touched upon. It was asked why the same gas is not produced in a blast furnace when the combustion is perfect. It was pointed out in reply that carbonic acid gas is first produced in a blast furnace, part of which is converted in passing through the charge of coke, by taking up additional carbon, into carbonic oxide (CO). In the cupola the gas does not have the opportunity of going back to carbonic oxide owing to the thinness of the melting zone.

The discussion then drifted to the proper height of the cupola and it was pointed out that it is desirable to have the cupola high enough so that the issuing gasses may be able to heat the charge and at the same time take the moisture out of the coke, which is a big factor when the coke has been exposed to rains for several days.

Other facts regarding cupola practice were brought out. It was stated that when there is not the proper combustion there are flames issuing from the top of the cupola, which not only indicates a waste of fuel, but also makes the charging of the cupola an extremely hazardous task. It was related by Dr. Moldenke that one cupola came to his notice that did not have the proper amount of draught. It was much narrower at the top than at the bottom and when the top was torn off and rebuilt with a larger vent no more trouble was experienced. The fact that no trustworthy wind gauge has been devised to measure the volume of air entering the cupolas, came up for considerable discussion. Where a series of cupolas is being blown the pressure gauges may

XUM

show the same amount of pressure for each cupola, but at the same time the first cupola may be receiving nearly all the blast while comparatively little may be entering the other cupolas. Dr. Moldenke suggested that an instrument in use, while he was engaged in making coast surveys for the United States government, for measuring the volume of water entering and flowing out of New York harbor, if properly modified could be utilized with good results in measuring the volume of air entering each cupola.

## DISCUSSION ON MR. E. B. GILMOUR'S PAPER ON "CRYSTALLIZATION OF METALS."

Mr. Asa W. Whitney: The correspondence of what Mr. Edward B. Gilmour says in his article on "Crystallization of Metals" with what I proved by a careful experiment with some flat and some square bars of chilled Iron in 1895 and reported in the Journal of The Franklin Institute, April, 1897. At the end of the second paragraph of that paper I said, "The Phenomena noted are therefore due to the relations of stress and chill, and, as a matter of fact, show to a considerable extent in cast iron suitable for purposes other than chilled castings." One of the photogravures in my paper showed the fracture of a square test bar of close, but almost non-chilling, iron two of whose opposite sides had been cast in contact with iron "chillers." The obvious independence of Mr. Gilmour's experience in this direction in gray iron is of course highly confirmatory of what I have written. However, for the sake of completeness and to further any deductions in this line the connection between the phenomena considered in the two articles is worthy of note by those who are, with Mr. Gilmour, interested in the proper designs for castings and by those who are studying the matter of proper shapes for test bars.

## DISCUSSION ON THE QUESTION OF TRAINED METALLURGISTS IN THE FOUNDRY.

Mr. E. H. Putnam: (The Tradesman, July 1.)—Mr. J. G. Sadlier, of Springfield, O., believed that, to date, chemistry in the foundry had done as much harm as good. He thought that close application to the practical features of iron founding would develop the successful foundryman; that phenomena resulting from cupola management would often neutralize the previous calculations of the chemist. That Mr. Sadlier is correct in this latter can-

not be denied. And since this is true, it necessarily follows that, if the chemist would be of real utility in the foundry, he must be expert in cupola management; and he must also, at all times, personally oversee the preparation and operation of the cupola. Because to trust this in the hands of another would be to incur the risk of having his calculations, based on analysis and general chemical knowledge, knocked out by mismanagement of the cupola on the part of someone else.

Major Malcolm McDowel, by the aid of chemistry, metallurgy and an intimate knowledge of foundry practice, had worked up 8,000 tons of accumlated scrap, producing the grades of castings desired, while at the same time effecting extraordinary economies. If, to have used up this quantity of scrap with perfect success, by a foundryman who knows nothing whatever of chemistry, were an achievement at all difficult, it might have amounted to a strong point in favor of the chemist. But it happens that it is not a difficult matter to a competent foundryman, who understands the indications of fracture.

If the scrap referred to by Maj. McDowel was all of one grade, then a single determination would have answered for the whole 8,000 tons. This could have been accomplished by simply sending some of the drillings to some competent, reliable chemist. The inference is, however, that the scrap was of different grades—that it had to be assorted, according to analysis. But to assort scrap iron of different grades which has accumulated through a long period of foundry operations, by analysis, is an obvious impossibility, unless you analyze each separate piece. And Maj. McDowel did not do this; he hasn't lived long enough! What then was the secret of his success? Simply, his knowledge of founding and metallurgy: and that without any help from chemistry whatever. Certainly, he may have employed analysis; but that is not to say that he got any benefit from it. How was his 8,000 tons of scrap assorted? If it was assorted at all, it was by fracture; the one and only way by which a mixed lot of scrap iron of unknown grades can be assorted (except, as said above, by analysis of each separate piece, which would consume the labor of an army of chemists for a lifetime). And if the iron was assorted by fracture, what further benefit could have been derived by subsequent analysis? It may be answered that the iron was assorted

XUM

into separate piles, and a determination was taken from each pile. But look out! you are giving away your case! How do you know that the balance of the pile is anything like the piece analyzed? You don't mean to say that you are going to leave it to the judgment of the man who assorted it by fracture?

When a man tells you that he grades mixed scrap iron, as it comes from the scrap iron dealer, by chemical analysis, ask him how many thousand chemists he employs. If he answers that he employs less than ten thousand, you will be justified in assuming that he is operating a very small foundry, and that the wages of chemists are very low in his town.

When either pig or scrap iron once becomes mixed beyond recognition there is only one possible way of re-grading it, and that is by fracture. All pig iron, as it comes to the foundry, is, for aught the foundryman knows, mixed. The man that he bought it of may know that it is not mixed. But the only way by which the buyer can determine the question, independently of the seller, is by fracture; unless he analyze each separate piece. And if you are willing to take the seller's word for all but three pieces (which your chemist selects for analysis) of the car load, it ought not to take a great stretch of confidence to trust him for the three pieces also! And this is my cue for the remark that the place for the chemist is at the furnace.

Mr. Asa W. Whitney:—Mr. E. H. Putnam's method of dealing with Major McDowel's success in using large amounts of scrap which other founders without proper chemical knowledge had allowed to accumulate, savors of the cock-sureness of the hustler. But neither Nature nor proper discussion of results attained by attention in following her will be hustled. Usually but one respectful question at a time can expect an answer. Our critic would ask more. But it is presumable that Major McDowel in attaining sufficient metallurgical success for his purposes had previously obtained answers to necessary questions in the premises. And it is not likely that he asked them all at once, but often and during a period of some years. His positive evidence, agreeing in success with that of several others, including that of the writer since 1889 outweighs, in the ratio of deeds to doubts, all negative and inappreciatively critical testimony. In the light of the recent advances in the application of iron analysis as part

of foundry metallurgy, it is evident that the hackneyed claim as to the necessity of analyzing each piece of scrap and pig in a presumably mixed lot results from genuine ignorance of the practical meaning and proper method of applying well directed complete analyses.

But that claim is probably not quite so sure of its position as formerly. But putting forth the wrong foot when in doubt as to proper position, one becomes more positive as to which is the best foot to put forward. This phase of conversion is well known.

But really it is too late in the day to base a curriculum for belated students upon the explanations of ancient erroneous opinions. There is no necessity, though of course much interest, to teach chemistry by following all the steps of the alchemists. What they did or did not believe to be practicable concerns us far less than what their and our efforts have practically resulted in for prompt use in the foundry or in teaching with economy of material and labor.

Of course there may be many who unthinkingly hold Mr. Putnam's evident idea that when one works by calculations on analyses he is thereby debarred the advantage of the fact that metal of practically equivalent physical character has been for years known to be compatible with considerable differences in ultimate analysis. In fact this is even yet put forth as one of the strongest arguments against the reasonableness of practicability of relying upon any close correspondences between the apparently erratic figures and the accompanying physical results. When however one has learned by careful study of complete analyses over wide range of composition, the practical meaning of this cipher code, and applied it with increasing success to the closest regulation of quality and cost of product, an outburst of negative testimony may arouse his enthusiasm as well as mirth but hardly to the extent of self-denying missionary zeal while he has his own affairs to attend to. Our critic claims it was "Simply his knowledge of founding and metallurgy" to which McDowel owes his success, denying that he got any benefit from any analyses he may have employed. Modern metallurgy consists largely in the application of proper calculation to analyses along with best use of all other conditions. In my own experience the small amount of well directed analysis necessary for the use of large

XUM

percentages of scrap in various lines of work made to close specifications (and meeting them) has always been a matter of surprise to many who forget that all common sense is not thrown overboard when one steers by chemistry.

"When any man his batter'd head
Above his struggling kind has lifted;
The knowing ones at once decide
Success came not because he tried.
Oh, no! the man was gifted!"

Dr. Edward Kirk:—(In Iron Trade Review, July 12.) Probably no man in this country or any other has had a wider or more varied experience in cupola management than the writer. I have melted iron in foundries in 21 States and many of the provinces of Canada, and in cupolas varying in inside diameter from 12 inches to 10 feet; and melting from a few hundred weight per hour to 15 tons per hour; in a cupola consisting of a pair of sugar hogsheads, lined with red brick and blown with a pair of bellows, and in cupolas encased in steel and blown with the most improved blowers. My experience has been varied to include the smallest jobbing shop with one molder, and a foundry employing hundreds of molders, and making from the lightest to the heaviest of castings. I can assure the young chemist, that there is no mystery about a cupola; no devils to jump from the charging door and devour him, or evil spirits to emerge from the top holes and tuyeres. It is the kindest and gentlest of furnaces, and the most easily managed of any of the furnaces, employed in the melting of iron.

It is not necessary in becoming a melter, that the chemist should be a pattern-maker, dry or green sand molder, or an expert on molding sand, facing, etc. Not one melter in a thousand has a practical or theoretical knowledge of these things. No calorimeter, pyrometer or other instrument has yet been invented that will indicate the degree of heat in a cupola, and as far as the temperature at which iron should be poured, that is a matter to be judged by the eye, and a matter in which the melter has nothing to do; for the melter's responsibilities of iron ends at the spout, in all foundries.

If he has properly mixed and melted the iron, he has done

his whole duty; and if castings are lost, he must look to the molder and not to the melter, for the cause of loss. And every practical founder does this, and places the blame where it belongs. There is no mystery about melting iron in the cupola; only a little theoretical and practical knowledge combined with common sense is necessary to become a first-class melter.

The common sense the chemist is supposed to have to begin with; the theoretical knowledge may be obtained by a careful study of any practical work on cupola management; and the practical knowledge may be obtained in ten days' actual work at a cupola, under a competent instructor. This is making a liberal allowance of time for practical instruction, for I have made many a good melter in from three to six days, and would willingly undertake to instruct chemists in the supposed mystery of a cupola in this length of time, free of charge, if I were so situated as to do it. But I am not engaged in the foundry business at the present time, and have no cupola with which to give such instruction. The mixing of iron from analysis may readily be learned at the same time cupola practice is being learned, from a little practical instruction from any one who has made a study of mixing by analysis.

And according to Mr. West the mixing of iron may be learned in much less time; for he has offered to instruct any foundryman in one evening, free of charge, in all the mysteries of mixing iron by analysis, who will call upon him at his residence at Sharon, Pa. But Mr. West is so unalterably opposed to the advancement of foundry chemists that he went before the American Foundrymen's Association at Chicago, with a written criticism on my paper advocating the advancement of foundry chemists and the improvements of foundry irons.

I agree with Prof. Robert H. Richards, of the Massachusetts Institute of Technology, that the advancement in foundry practice should be step by step, and not by long strides. The first step should be taken in the advancement of cupola practice and improvement in foundry irons, for this is the foundation upon which the entire structure of foundry practice rests. It makes no difference how many thousands of dollars are spent for patterns, flasks, cupolas, blowers, cranes, sand, facing and all of the various foundry fixtures. A satisfactory casting cannot be produced

XUM

without a properly mixed and melted iron; and there is no branch of the foundry business so sadly neglected as this.

In the majority of foundries, we find foremen, who know nothing about cupola practice, and the melting of iron is entrusted entirely to the melter, a man who in many cases can scarcely read his own name or make out a cupola sheet. The results obtained in melting from such men are very uncertain, and scarcely two heats are melted alike; and in many cases iron is not of an even temperature throughout a heat. Such melting does not produce an even grade of castings. All this may be remedied in ten days, by instructing the chemist in the mixing and melting of iron, and one grand step forward taken in foundry practice.

While to train boys or young men in all the details of foundry practice years are required. And that they may reach the age of mature judgment many more years are required so that nothing can be hoped for in the shape of advancement in foundry practice from such a course of training in less than eight or ten years. Let such a course of training be instituted for future generations and it will no doubt be of a decided advantage to them. But the present generation of foundrymen cannot afford to wait for these men. What they want is practical men at once and these men are the chemists who have already been trained and are looking for employment.

(*Journal of the American Foundrymen's Association.*)

VOL. IX. PART II.

# PROCEEDINGS OF THE GERMAN FOUNDRYMEN'S ASSOCIATION, THIRTY-SECOND CONVENTION, COLOGNE, AUGUST 17, 1900.

*EISENZEITUNG No. 34, et. seq.*

According to program, the convention was held in the "Twelve Apostles," for the time being an exposition at which many exhibits of foundry appliances and machines were to be seen. In the absence of the president Privy Counselor Buderus, one of the directors, Mr. Waldesleben, welcomed the members and laid special stress upon the value of these exhibits of foundry appliances to the trade at large. One hundred foundry firms were represented. The convention was opened by the vice-president, Privy Counselor Juengst, who cautioned the members against undue business optimism and pessimism. These gatherings were intended to give the members a chance to discuss matters and thus keep the trade in a healthy state. After the report of the general secretary was read (which will be commented upon further on), a motion was made by one of the members to create a medal to be given to deserving workmen who have been faithful to the firm donating it for many years. Another member told of his method, which was to issue certificates of honor to his workmen at the anniversaries of their 10th, 20th, 25th and 40th working year. The certificates were redeemable at the will of the recipient for $25.00 and interest. At first the certificates were redeemed quite frequently, but later on very rarely. It was resolved to take up the question with the German Iron and Steel Institute, the German Engineer's Society, and the Society of Iron and Steel Industries, for joint action.

The American workingman wearing a gold medal for continuous service, or receiving a bonus at stated intervals which is redeemable with interest, would be interesting to contemplate.

The Dean of the Berlin-Charlottenburg Institute of Technology urged the necessity of thoroughly training the future engineers and founders before they enter their duties in the shop. This was discussed by Dr. Beumer, who stated that a course of practical work should intervene between the preparatory course and the collegiate. The memorial was adopted and a call made for those foundries which would apprentice such a student for the period of one year.

Herein again do the Germans agree with us on the necessity of better educated foundry managers.

The German Engineers' Society reported the fact that they were getting up a dictionary of technical terms in German, French and English, and asked the foundrymen for their collaboration.

A committee was appointed to wait upon the Minister of Railways to rescind an order which prohibits the marking of castings as fragile when consigned to the State Railways. The Minister had already granted the return of castings broken in transit free of freight charges (which would seem to indicate that the State Railways are not responsible for breakage in transit).

Prof. Kamp asked for assistance to get out a book on "Houses and Home Life of Workingmen," which was granted.

The standardization of stove plates and rings was postponed until the next convention.

The estimated income for 1901-2 was $3,932, and the membership 303. The question of prices was discussed, and the regular list continued in force as it was.

General Secretary Bueck now delivered an address, in the course of which he reviewed the recent laws passed in Germany in the interest of social economy. This address will be reviewed in the Journal at another place, the treatment of labor, insurance, etc., in Germany being of great interest in this country.

The convention now adjourned to a banquet, at which, contrary to our American custom, the majority of the guests were the wives and daughters of the delegates. Speeches were the order of the day, and a special telegram was sent to his Majesty the German Emperor. The next place of meeting is to be Dresden. A paper was read on the causes for bad castings by Prof. Wuest, of Duisburg, which will be commented upon specially.

XUM

In glancing over the list of exhibitors we cannot help being struck by the enterprise shown in this regard. American machine tools were very much in evidence as a matter of course, and we will give a few of the interesting items to show the chance our foundry supply people may have over there. The Pridmore molding machine was there in full operation, Norton wheels, American core ovens, name not given, as well as American sand sifters. A German ball grinding mill for preparing molding sand would seem something to interest us. Emery wheels, coke piles, core ovens, sand-blast devices, flask clamps, hydraulic cranes, fans, blowers, ladles, hydraulic molding machines, wood trimmers, chaplets, crucibles, molding sand, foundry heating systems, etc., all of German make, but strangely accompanied by the legend that they are similar to the American article and just as good, all these show us that other nations are pushing us in the development of the industry.

Perhaps it would be well to have our foundry supply houses and makers of foundry machinery go to more trouble to show and explain the merits of their goods at our conventions than they have heretofore.

The report of the board of directors of the German Foundrymen's Association presents a number of points of interest to our American members, and as we are now beginning to export castings over to the other side, it may be well to know what brother "Michel" thinks of it.

Germany being essentially a country of laws and minute regulations, changes in the current commercial law are taken up first. The position of the selling agents has been greatly improved, and the special laws relating to commercial dealings have been greatly simplified and codified. The principal legislation has been in the direction of accident insurance, the tendency of the "Reichstag" being to throw continually increasing burdens in the way of accident taxation upon the industry in favor of the employe. The one law which was urged as especially desirable, that to protect the workingman who wants work, from his companions who will not, has still failed to pass. The increase in the navy is an agreeable feature, and will favor the foundrymen greatly. Chinese matters, zoll-verein, stamp taxes and Agrarian demands are discussed at length, but do not interest us specially, except that the latter troubles will tend to endanger Ameri-

XUM

can trade relations and embitter the Americans against Germany.

It seems that the most important work done by the Board of Directors during the year was in connection with the changes in the German tariff. The government having collected complete statistics on the subject of iron production, invited the German Foundrymen's Association to discuss and recommend possible changes in that portion of the proposed tariff which interested them most. The result of several conferences with other societies and the governmental committee, while still kept secret, points to a better and more liberal classification and treatment.

Regarding the state of trade, it is stated that the tone of the market was very firm, foundries were running full, and there was a noticeable lack of help, with a resulting rise of wages. Coke and iron was obtained with difficulty, and fell heavily upon those who had neglected to contract for these foundry supplies in time. The most favored branch of the foundry industry was the machine casting trade, which is still enjoying running contracts at good figures. Pipe founders had great difficulty to compete with those works which possess blast furnaces of their own. The conditions are such that selling prices for castings cannot drop for a long time to come. The form of the bill of sale for castings adopted by the German Foundrymen's Association has been generally adopted, and the customers find little to object to in it.

The record of strikes is heavier than usual, this in consequence of the good times. On the other hand, 31 lockouts are to be recorded also. The consequences, while in nearly all cases favorable to the foundry owners, have been very serious. The great strike in Leipzig, which lasted 22 weeks and ended in victory for the employers, has ruined the foundry trade in that city for a long time to come.

A further result of these troubles has been the formation of a company to insure its members against losses through strikes. The board of directors commends this new insurance company to the members.

The treasury of the Association has a surplus of $250. Fifty-five foundries furnished quarterly statistics of their product. The Association laboratory made 101 determinations for its members.

XUM

## PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA, PA.

As reported by the *Iron Age*, Sept. 13th, the one hundredth meeting of this association was held at the Manufacturers' Club on Wednesday evening, Sept. 5, Mr. J. S. Sterling, the vice-president, being in the chair. There was a large attendance. After disposing of the minutes of the previous meeting, the report of the treasurer was read. The financial standing was reported very good. Messrs. J. K. Dimmick & Co., pig iron merchants, and E. C. Stearns & Co., hardware manufacturers, of Syracuse, N. Y., were elected to membership. The paper of Mr. Mumford, on "The Problem of Machine Molding," was read by A. A. Miller, in the absence of the author. Considerable discussion followed the reading. Mr. W. H. Pfaler stated in the course of his remarks that "the molding machine would be the solution of the foundryman's difficulties and prove eventually his main safeguard."

The interest created was such that it was declared the sense of the association that manufacturers of molding machines be invited to appear before the associatioin to demonstrate by paper, and, if possible, by lantern slides, the features and working details of the various machines.

Mr. G. R. Lombard, of Augusta, Ga., spoke of the foundry conditions in his neighborhood, where they have no difficulties with their men. Molders command $2.00 to $2.50 per day and are satisfied. The output per day is not so large as in the north, however.

After adjourning a luncheon was served in the roof garden, Mr. Howard Evans acting as toast-master, introduced Mr. Lucien Tack, of Burcharest, Rumania (a member of the American Foundrymen's Association). Mr. Tack returned thanks for his courteous reception by the foundrymen of America, and dwelt upon the peculiar problems met with in his country, where oil is used as fuel for metallurgical purposes. Mr. P. D. Wanner spoke of the condition of the foundry business generally, and the agreeable social occasion came to a close.

XUM

*Iron Age*, Oct. 11th.

The meeting was called to order by the president, who at the same time made a brief address of welcome to the members. The minutes of the previous meeting were approved in the usual manner. The report of the treasurer showed the association to be in a flourishing condition.

Mr. Evans announced that in following the sense of the previous meeting in reference to having manufacturers of molding machines appear before the association, he had written a number of manufacturers, and received replies from several—the Maywood Foundry & Machine Company accepting, and probably will have a representative at the next meeting; the Atlas Engine Company, manufacturers of the Atlas, and the Reynolds Mfg. Company, manufacturers of the Reynolds molding machine, at present declining on account of press of business.

Applications for membership were received from the Davis Foundry Company, Lawrence, Mass., iron founders, and the American Machine & Foundry Company, Hanover, Pa., iron founders and builders of tobacco machinery. On motion, by which the secretary was instructed to cast a favorable ballot, their membership was declared.

This being the last meeting previous to the annual one, nominations for officers for the next year were in order. Thos. Dev. lin made a motion "that the present incumbents be nominated to succeed themselves." This motion was freely seconded, and nominations, by motion, declared closed. T. I. Rankin, president; H. Evans, secretary, and Josiah Thompson, treasurer, each objected, but were overruled. The various nominations are as follows: President, Thomas I. Rankin, Abram Cox Stove Company; vice-president, James S. Stirling, Harlan & Hollingsworth Company, Wilmington, Del.; treasurer, Josiah Thompson, Josiah Thompson & Co.; secretary, Howard Evans, J. W. Paxson & Co.; Executive Committee: Antonio Pessano, Geo. V. Cresson Company; Stanley G. Flagg, Jr., Stanley G. Flagg & Co.; E. E. Brown, E. E. Brown & Co.; Jno. Glover, Glover Bros.; Wm. Hauson, Pennsylvania Iron Works Company.

Business being concluded, a paper by A. D. Williams, Pittsburg, Pa., entitled, "Electric Traveling Cranes," was presented, but owing to the pressure of time was not read, but a copy presented to all present.

XUM

Mr. E. M. Mumford, of the Taber Manufacturing Co., was next introduced, and gave a comprehensive talk on the Taber molding machine and the Tabor vibrator.

Mr. C. L. Price, superintendent of the Foundry of the General Electric Co., Schenectady, N. Y., then presented a paper describing the new foundry of his company. The paper was accompanied by a large number of lantern slides descriptive of the arrangement and details of the plant.

A vote of thanks was tendered both him and Mr. Mumford for the interesting subject of the evening.

On motion of Mr. Davis the meeting adjourned to the roof garden, where lunch was served.

---

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The regular meeting was held Wednesday, Sept. 5th, in Frohsin Hall. Secretary F. H. Zimmers read the minutes of the last meeting, which were approved. The president appointed a committee on nominations, consisting of Messrs. Yagle, Keller and Logan. Mr. Edw. C. H. Walker, of the British Westinghouse Electric & Mfg. Co., was presented for membership. The paper of the evening by Mr. E. H. Mumford, on "The Problem of Machine Molding," was next read by the secretary, and an interesting discussion followed. After adjourning lunch was served, and an opportunity given to the members to continue the discussion on molding machines among themselves.

*Iron Trade Review*, Oct. 11th.

Officers for the ensuing year were elected at the regular monthly meeting of the Pittsburg Foundrymen's Association held Wednesday evening, Oct. 3, at 305 Penn avenue. The ticket selected by the nominating committee was unanimously elected. The officers are as follows: President, S. D. Sleeth, Westinghouse Air Brake Co.; vice-president, John McClaren, Phillips & McClaren Co.; treasurer, Philip Mathes, Brittain & Mathes Co.; secretary, F. H. Zimmers, Union Foundry & Machine Co.; executive committee, Dr. R. G. Moldenke, Pennsylvania Malleable Co.; J. S. Early, W. J. Early & Sons; J. S. McDonald; D. P. Thomas, Sterritt & Thomas; John A. Logan,

*Iron Age*, Oct. 11th.

The meeting was called to order by the president, who at the same time made a brief address of welcome to the members. The minutes of the previous meeting were approved in the usual manner. The report of the treasurer showed the association to be in a flourishing condition.

Mr. Evans announced that in following the sense of the previous meeting in reference to having manufacturers of molding machines appear before the association, he had written a number of manufacturers, and received replies from several—the Maywood Foundry & Machine Company accepting, and probably will have a representative at the next meeting; the Atlas Engine Company, manufacturers of the Atlas, and the Reynolds Mfg. Company, manufacturers of the Reynolds molding machine, at present declining on account of press of business.

Applications for membership were received from the Davis Foundry Company, Lawrence, Mass., iron founders, and the American Machine & Foundry Company, Hanover, Pa., iron founders and builders of tobacco machinery. On motion, by which the secretary was instructed to cast a favorable ballot, their membership was declared.

This being the last meeting previous to the annual one, nominations for officers for the next year were in order. Thos. Devlin made a motion "that the present incumbents be nominated to succeed themselves." This motion was freely seconded, and nominations, by motion, declared closed. T. I. Rankin, president; H. Evans, secretary, and Josiah Thompson, treasurer, each objected, but were overruled. The various nominations are as follows: President, Thomas I. Rankin, Abram Cox Stove Company; vice-president, James S. Stirling, Harlan & Hollingsworth Company, Wilmington, Del.; treasurer, Josiah Thompson, Josiah Thompson & Co.; secretary, Howard Evans, J. W. Paxson & Co.; Executive Committee: Antonio Pessano, Geo. V. Cresson Company; Stanley G. Flagg, Jr., Stanley G. Flagg & Co.; E. E. Brown, E. E. Brown & Co.; Jno. Glover, Glover Bros.; Wm. Hauson, Pennsylvania Iron Works Company.

Business being concluded, a paper by A. D. Williams, Pittsburg, Pa., entitled, "Electric Traveling Cranes," was presented, but owing to the pressure of time was not read, but a copy presented to all present.

XUM

Mr. E. M. Mumford, of the Taber Manufacturing Co., was next introduced, and gave a comprehensive talk on the Taber molding machine and the Tabor vibrator.

Mr. C. L. Price, superintendent of the Foundry of the General Electric Co., Schenectady, N. Y., then presented a paper describing the new foundry of his company. The paper was accompanied by a large number of lantern slides descriptive of the arrangement and details of the plant.

A vote of thanks was tendered both him and Mr. Mumford for the interesting subject of the evening.

On motion of Mr. Davis the meeting adjourned to the roof garden, where lunch was served.

---

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The regular meeting was held Wednesday, Sept. 5th, in Frohsin Hall. Secretary F. H. Zimmers read the minutes of the last meeting, which were approved. The president appointed a committee on nominations, consisting of Messrs. Yagle, Keller and Logan. Mr. Edw. C. H. Walker, of the British Westinghouse Electric & Mfg. Co., was presented for membership. The paper of the evening by Mr. E. H. Mumford, on "The Problem of Machine Molding," was next read by the secretary, and an interesting discussion followed. After adjourning lunch was served, and an opportunity given to the members to continue the discussion on molding machines among themselves.

*Iron Trade Review*, Oct. 11th.

Officers for the ensuing year were elected at the regular monthly meeting of the Pittsburg Foundrymen's Association held Wednesday evening, Oct. 3, at 305 Penn avenue. The ticket selected by the nominating committee was unanimously elected. The officers are as follows: President, S. D. Sleeth, Westinghouse Air Brake Co.; vice-president, John McClaren, Phillips & McClaren Co.; treasurer, Philip Mathes, Brittain & Mathes Co.; secretary, F. H. Zimmers, Union Foundry & Machine Co.; executive committee, Dr. R. G. Moldenke, Pennsylvania Malleable Co.; J. S. Early, W. J. Early & Sons; J. S. McDonald; D. P. Thomas, Sterritt & Thomas; John A. Logan,

Jones & Laughlins, Ltd. The outgoing officers were tendered a vote of thanks and President S. D. Sleeth assumed the chair.

The paper on "Electric Traveling Cranes," prepared by A. D. Williams, of the Shoenberger works of the American Steel & Wire Co., was then read by the author. A discussion followed in which Mr. Williams was called upon to answer many questions concerning cranes in general, and he elaborated on some of the points he had brought out. A vote of thanks was then tendered Mr. Williams for his excellent paper.

The question of having every member of the various local foundrymen's associations allied with the American Foundrymen's Association become members of the national organization was then brought up and discussed at some length. It was stated that but few of the 67 members of the Pittsburg association are members of the national body, and ways and means were suggested for having every member of the local body join the national organization with only a small additional cost for annual dues. At the present time the annual dues for members of the local organizations, who become members of the national body, are $5 per year. For members not connected with locals the dues are $10 per year. It was stated that unless there is an increase in the membership of the national organization it would be difficult to carry on the educational work of the Association successfully. After considerable discussion it was decided to refer the matter to the executive committee to report at the next monthly meeting. It is believed the Pittsburg Association will lead the way toward making all local associations branches of the national body and all members of locals will be members of the national organization by virtue of such membership.

## DISCUSSION OF MR. JEWETT'S PAPER ON THE "REAL FUEL RATIO."

*Eisenzeitung*, August 9th, gives our American cupola practice a rather sharp jolt and incidentally includes the American Foundrymen's Association in the criticism. Here is the literal translation: "That the far-famed American foundry management leaves much to be desired as yet, is seen from the following paper read by Mr. L. C. Jewett at the recent convention of the

American Foundrymen's Association. Among other things Mr. Jewett says:" (Here follow extracts from the paper, giving the interview between superintendent and foreman, see Part I., page 28 et seq.). An editorial foot-note says, further, "The practice in this foundry seems indeed to be at a very low level when it is based upon such crude experiments. What we wonder at most, however, is that such an eminently practical society" (meaning the American Foundrymen's Association by this) "by refraining to discuss the matter, seems to indicate that 1:8 is the proper and self-evident ratio of daily practice."

Here is a chance for our members to go on record. The question is evidently, "Is a jobbing foundry with 20 tons daily production, and taking no chances, by running 1:8, doing so poorly as is imagined in Germany?"

## DISCUSSION OF MR. MUMFORD'S PAPER ON "THE PROBLEM OF MACHINE MOULDING.

*Tin and Terne*, Mr. B. V. Luty, the editor, reports the discussion at the meeting of the Pittsburg Foundrymen's Association as follows:

In inviting a discussion of the paper the president, Dr. Moldenke, said that there were several ideas in each paragraph of the paper, containing many points that furnished fit subjects for discussion and elaboration. The thought was new that on account of the ease with which duplicate castings could be made there would be a greater demand for the difficult castings which could be made only by hand. He thought the present outlook made the molding machines a necessity, and inquired if anyone present had any information in regard to machines for making cores.

Mr. Fisher stated that he had lately introduced two molding machines, and found that the great difficulty in using unskilled labor with them was the difficulty in pouring off. It was not hard to teach the unskilled men to operate the machines quite successfully, but when it came to pouring off there was likely to be more or less trouble, as the operation requires considerable skill. It was suggested at this point that some one in the foundry be especially trained to pour off, instead of expecting the unskilled men who operated the machines to pour

off. It was held that it would take several months to teach men to pour off, there being many tricks in the trade. In Mr. Fisher's foundry the work was especially difficult, as the castings were small ones for meters, being only $\frac{1}{8}$ inch thick in some places, yet required to stand a pressure of 100 pounds. If the pouring is not done right, the castings have strains and will not bear the pressure. He has now one skilled molder, a core man and a boy to cope, the skilled molder being required for the pouring. The trouble with the regular molders is that they do not want to pour off another man's work. When there are men engaged on hand work who are called off from their regular work to pour for the machine product, they have no sympathy with the machine and do not do the best work, the result being strained castings frequently. But Mr. Fisher stated that there was no comparison between the machine and hand work, the machine doing four times as much as could be done by hand, and the work being done much better. He had abandoned the jarring feature in his machine, and was ramming by hand.

Mr. Sleeth suggested that the strains produced by unskilled pouring might be largely obviated by introducing another gate. It was stated that skimmers had been introduced with success to avoid the men spoiling the work.

A foundryman stated that he had had considerable trouble when he first introduced the machine, the great trouble being the pouring off. He had from 250 to 275 molds to be poured from 30-pound hand ladles. He had found great difficulty in trying to break in new men to pour. They got iron into their shoes, and had all kinds of trouble. Now he presses into the pouring service all the molders and core makers in the shop.

It was pointed out that the matter of pouring was a problem which should be attacked in a regular manner. Nearly every mold is poured differently, and a new man must learn all the tricks before he can do all classes of work properly. It is better to employ good men with the machines, who would be cheaper in the long run. With green men there would be so much loss that the advantage of the machine would be wiped out. The experience of one member was that it took about six months to break a man to pour some given class of work,

XUM

and by training several to different classes, a foundryman is prepared for all ordinary kinds of work. The opinion expressed was that the true field of the molding machine was simply to relieve the brains of the hard work attendant with hand molding.

Mr. Sleeth stated that in his work he was breaking in new men all the time, and as opportunity afforded he started them first in the easier jobs. In regard to getting the experienced molders to pour off, it was pointed out that frequently a machine would in a day do work which would require a molder two months to do by hand. It was rather difficult to persuade a good molder that the introduction of such a machine was for his benefit, hence if he is called upon to pour off such a lot of work he is likely to object and in any case will not do the best work. It was found in one experience that the loss is about the same with machine as with hand molding. With hand molding the men do not always pour properly either.

A point was made with reference to the pouring of white iron, in malleable work. It was difficult to get men accustomed to pour gray iron to handle the white iron properly, because the latter is of a dazzling whiteness, like steel, when of no higher temperature than gray iron, and it took some time to get the men used to this different appearance.

It seemed to be the general opinion that the claims advanced by the manufacturers of molding machines were too high, and it was suggested in some cases that they hurt their own business, as prospective buyers were frightened off when they learned, as in some cases cited, that the whole product of the shop for a year could be molded by machine in three days. There would not, of course, be cupola capacity sufficient to handle the work so rapidly. Then, again, the big claims made for the machines induced the purchasers to push them too hard, with the result that they would not work right. A case was mentioned where the speaker knew that a molding machine which was thrown into the cupola was really a good machine, for a reasonable and perfectly satisfactory amount of work, but had failed to come up to the exaggerated claims made for it by the seller. It was a good machine, but not nearly so good as had been claimed. An illustration of this principle was cited in the case of an Altoona shop where some iron was purchased to

XUM

be of a certain analysis and grade. The blast furnace for the first shipment sent a carload which was far above the requirements. The second car was well within the limits, but was so much poorer than the first shipment that the purchases thought something was wrong, and rejected the whole shipment.

In connection with the claims of the molding machine manufacturers there was some criticism as to the variety of work capable of being made. When there are a large number of the same piece to be cast the molding machine shows its greatest efficiency. Then there are classes of work to which it is well suited, and other kinds of work, more difficult, to which it is not so well suited. Its value varies for different kinds of work, and the opinion was that the cause of the molding machine has been injured by claims made that it could do all kinds of work and do each kind much better than by hand. This led to skepticism as to the whole subject on the part of foundrymen.

A particularly rapid machine was mentioned, which was the invention of a Cleveland man, and operated somewhat on the principle of the turret lathe. This machine would make about 3,000 molds a day, which was an enormous output, and more than the regular molding machine would do, but the difficulty was that the machine operated so fast that it was impossible to see into the molds as they were made, and all that came from the machine had to be poured. Many of them were defective, resulting in defective castings, which had to be thrown out, and the loss from these was so great that the machine had to be abandoned. Had it worked slower, and in such a way that the molds could be examined, the great loss of castings would be prevented, and this would have much more than have made up for the slightly greater cost of molding owing to the slower operation.

*Iron Trade Review*, Oct. 11th, reports the discussion of Mr. Mumford's paper at the meeting of the Philadelphia Foundrymen's Convention:—

Secretary Evans stated that the presence of Mr. Mumford was due to the wish generally expressed at the last meeting that Mr. Mumford should appear before the association, in further support of his paper on molding machines read in his absence at the September meeting. Mr. Mumford exhibited a model

XUM

of working parts of the latest type of molding machine made by his company, and explained its working. In the presentation of the model, he added that while he had no further paper to read, he had with him all he knew about the Tabor molding machine, and such knowledge was at the service of those present. He had been asked since the publication of the paper to give the basis for the statement that in one shop a molder made 65 flasks for $2.75 wages, whereas in another shop on exactly the same work and with the same machines an unskilled employe made 160 flasks for $2.40, or 1½ cents per flask. The information called for was of such a nature that it would be imperative to have the permission of the concern operating the foundry before quoting them, consequently for the present the figures would have to be taken as facts. He thought the members would be interested in an exhibition of the latest development of the molding machine as far as that special part of it was concerned which affected the drawing of the pattern, and the apparatus was now before them. The pattern in process of molding was a lamp base, and the use of the new vibrator frame to facilitate the drawing of the pattern was fully explained. He pointed out the great economy found in using solid patterns instead of stripping plates. Fully 400 patterns, he said, had been used with only 15 frames, making the cost much less than where plates were used. The vibrator was simply a plunger moving in a cylinder and striking both ends. It was found that 1⅛-inch vibrator made about 5,000 strokes per minute. The one then before the meeting made perhaps five or six times as many strokes. The device was practically composed of four pieces, and might be termed a pneumatic tool. When running a vibration was set up in the frame, and on account of its evenness might be termed a molecular vibration.

At Mr. Moore's request Mr. Mumford explained that the operator does two things at once—lifting the cope while the vibrator is running and the sand is touching the pattern. Owing to the vibration the sand is perfectly free, and a clear lift is made. There is a marked feature in the machine. The casting came out absolutely the length of the pattern, which is not at all the case in hand molding. Again, the use of the machine cheapens the cost of the pattern immensely. The gates, of course, must be strong enough to prevent the patterns from springing from their own weight. A metal pattern always works better than

a wooden one, as this will not stand brushing up. It is always best in ordering machines to actually have it understood for what class of work they are intended.

---

## PROCEEDINGS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

### Progress Report of the Committee on Standardizing the Testing of Cast Iron.

### CAST F—SASH WEIGHT IRON.

This set of 64 bars, cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on Standardizing the Testing of Cast Iron, furnished 64 tests; others are to follow.

Cast F illustrates a class of castings made of practically the shop scrap, which is unfit for even ordinary castings. This particular heat contained burnt iron salamanders, scrap grate bars, some rusty thin malleable scrap, and a white weak pig iron. The result is a set of bars which have a perfectly white fracture up to $2\frac{1}{2}$ inch sections, and a slight mottling in the center only for the larger ones.

The fluidity strip did not run up full, showing the effect of oxidized iron; the chill extended throughout the whole casting made for the purpose.

The bars were made by the Secretary and presented to the Committee in the interest of the trade.

As it was impossible to machine this iron, no tests in that direction were made. The analysis of the 1in. square dry sand bars is as follows:

| | |
|---|---|
| Total carbon | 2.71 |
| Graphite | .20 |
| Silicon | .91 |
| Manganese | .24 |
| Phosphorus | .441 |
| Sulphur | .218 |

XUM

**Table No. 1.**

Series F.

TRANSVERSE TEST.

Sash Weight Iron—Bars in Green Sand and not Machined.

| Square Bar. | Approx. Cross Section. | Actual Size. Depth. | Width. | Breaking Strain. | Deflection. | Contraction. |
|---|---|---|---|---|---|---|
| No. | Ins. | Ins. | Ins. | Lbs. | Ins. | Ins. |
| 1048* | 0.5x0.5 | .51 | .52 | 90 | .040 | .30 |
| 1049 | 0.5x0.5 | .52 | .52 | 140 | .090 | .. |
| 1050 | 1x1 | 1.00 | 1.01 | 3,040 | .075 | .. |
| 1051 | 1x1 | 1.00 | 1.00 | 2,870 | .080 | .. |
| 1052 | 1.5x1.5 | 1.48 | 1.49 | 11,390 | .065 | .. |
| 1053 | 1.5x1.5 | 1.51 | 1.47 | 10,600 | .070 | .. |
| 1054 | 2x2 | 2.00 | 2.01 | 25,440 | .060 | .18 |
| 1055 | 2x2 | 1.98 | 2.02 | 29,380 | .040 | .. |
| 1056 | 2.5x2.5 | 2.49 | 2.49 | 41,575 | .045 | .. |
| 1057 | 2.5x2.5 | 2.48 | 2.50 | 44.010 | .040 | .. |
| 1058 | 3x3 | 3.00 | 3.01 | 61,600 | .040 | .. |
| 1059 | 3x3 | 3.00 | 3.00 | 66,740 | .040 | .. |
| 1060 | 3.5x3.5 | 3.49 | 3.54 | 77.100 | .035 | .14 |
| 1061 | 3.5x3.5 | 3.53 | 3.55 | 81,360 | .020 | .. |
| 1062 | 4x4 | 4.04 | 4.06 | 96,320 | .020 | .12 |
| 1063 | 4x4 | 4.01 | 4.04 | 87,540 | .020 | .. |

*Flaw.

**Table No. 2.**

Series F.

TRANSVERSE TESTS.

Sash Weight Iron.—Bars in Dry Sand and not Machined.

| Square Bar. | Approx. Cross Section. | Actual Size. Depth. | Width. | Breaking Strain. | Deflections. | Contraction. |
|---|---|---|---|---|---|---|
| No. | Ins. | Ins. | Ins. | Lbs. | Ins. | Ins. |
| 1064 | 0.5x0.5 | .50x | .54 | 110 | .070 | .29 |
| 1065 | 0.5x0.5 | .51x | .52 | 130 | .070 | .. |
| 1066 | 1x1 | 1.00x1.01 | | 2,640 | .060 | .27 |
| 1067 | 1x1 | .98x1.01 | | 2,050 | .065 | .. |
| 1068 | 1.5x1.5 | 1.51x1.52 | | 10,540 | .040 | .24 |
| 1069 | 1.5x1.5 | 1.49x1.50 | | 9,100 | .060 | .. |
| 1070 | 2x2 | 2.00x2.00 | | 26,540 | .040 | .20 |
| 1071* | 2x2 | 2.00x2.01 | | 19,620 | .030 | .. |
| 1072 | 2.5x2.5 | 2.53x2.50 | | 37.610 | .035 | .16 |
| 1073 | 2.5x2.5 | 2.49x2.50 | | 38.440 | .030 | .. |
| 1074 | 3x3 | 2.99x2.98 | | 54,530 | .030 | .14 |
| 1075 | 3x3 | 2.98x2.98 | | 60,970 | .020 | .. |
| 1076 | 3.5x3.5 | 3.50x3.51 | | 72,060 | .030 | .12 |
| 1077 | 3.5x3.5 | 3.47x3.45 | | 78.400 | .025 | .. |
| 1078 | 4x4 | 4.00x4.03 | | 94,000 | .020 | .11 |
| 1079 | 4x4 | 4.01x4.00 | | 88.850 | .020 | .. |

*Flaw.

Series F.

**Table No. 3.**

TRANSVERSE TESTS.

Sash Weight Iron—Bars in Green Sand and not machined.

| Round Bar. | Aprox. Diam. | Actual Size. Depth(d) | Width(d) | Breaking Strain. | Deflection. | Contraction. |
|---|---|---|---|---|---|---|
| No. | Ins. | Ins. | Ins. | Lbs. | Ins. | Ins. |
| 1080 | 0.56 | 0.54 | 0.58 | 190 | .090 | .29 |
| 1081 | 0.56 | 0.53 | 0.54 | 150 | .080 | .. |
| 1082 | 1.13 | 1.14 | 1.12 | 2,920 | .085 | .26 |
| 1083 | 1.13 | 1.13 | 1.12 | 2,600 | .085 | .. |
| 1084 | 1.69 | 1.69 | 1.69 | 6,610 | .060 | .20 |
| 1085 | 1.69 | 1.68 | 1.70 | 5,940 | .065 | .. |
| 1086 | 2.15 | 2.13 | 2.14 | 14,960 | .070 | .. |
| 1087 | 2.15 | 2.16 | 2.16 | 16,000 | .050 | .. |
| 1088 | 2.82 | 2.80 | 2.81 | 36,970 | .035 | .16 |
| 1089 | 2.82 | 2.82 | 2.82 | 34,840 | .035 | .. |
| 1090 | 3.38 | 3.38 | 3.40 | 54,050 | .030 | .14 |
| 1091 | 3.38 | 3.41 | 3.41 | 54,800 | .025 | .. |
| 1092 | 3.95 | 3.98 | 3.99 | 74,660 | .020 | .12 |
| 1093 | 3.95 | 3.97 | 3.99 | 79,090 | .030 | .. |
| 1094 | 4.51 | 4.55 | 4.50 | 90,100 | .020 | .11 |
| 1095 | 4.15 | 4.48 | 4.47 | 82,730 | .020 | .. |

Series F.

**Table No. 4.**

TRANSVERSE TEST.

Sash Weight Iron—Bars in Dry Sand and not Machined.

| Round Bar. | Approx. Diam. | Actual Size. Depth(d) | Width(d) | Breaking Strain. | Deflection. | Contraction. |
|---|---|---|---|---|---|---|
| No. | Ins. | Ins. | Ins. | Lbs. | Ins. | Ins. |
| 1096 | 0.56 | 0.54 | 0.54 | 140 | .085 | .28 |
| 1097 | 0.56 | 0.56 | 0.55 | 120 | .070 | .. |
| 1098 | 1.13 | 1.16 | 1.15 | 2.740 | .080 | .27 |
| 1099 | 1.13 | 1.17 | 1.14 | 2,400 | .080 | .. |
| 1100 | 1.69 | 1.69 | 1.70 | 7,990 | .065 | .. |
| 1101 | 1.69 | 1.74 | 1.70 | 9,360 | .065 | .21 |
| 1102 | 2.15 | 2.17 | 2.16 | 13,880 | .050 | .17 |
| 1103 | 2.15 | 2.15 | 2.18 | 17,620 | .055 | .. |
| 1104 | 2.82 | 2.82 | 2.83 | 38,330 | .055 | .15 |
| 1105 | 2.82 | 2.85 | 2.82 | 42,600 | .030 | .. |
| 1106 | 3.38 | 3.40 | 3.42 | 60,770 | .020 | .14 |
| 1107 | 3.38 | 3.39 | 3.41 | 57,070 | .025 | .. |
| 1108 | 3.95 | 3.98 | 3.96 | 74,440 | .020 | .13 |
| 1109 | 3.95 | 3.99 | 3.97 | 81,120 | .020 | .. |
| 1110 | 4.51 | 4.50 | 4.50 | 87,530 | .020 | .12 |
| 1111 | 4.51 | 4.51 | 4.53 | 93,760 | .020 | .. |

XUM

VOL. IX. PART II.

## PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA, PA., NOV. 7, 1900.

*Iron Trade Review*, Nov. 15th. The regular monthly meeting was held at the Manufacturers' Club, Philadelphia, on Wednesday evening, Nov. 7th; President Thos. I. Rankin occupying the chair.

Secretary Howard Evans announced that some steps had been taken towards the establishment of a chemical laboratory to be owned and controlled by the association. The matter, he said, had been in the hands of the executive committee since the last meeting of the association, and the views of most of the members had been obtained on the subject.

A. C. Pessano, chairman of the executive committee, outlined the plans which had been considered for the scope of the laboratory and went over the work of his committee in the matter. It was believed, he said, that if sufficient funds were taken from the treasury of the association to cover the establishment of the laboratory the maintenance would be fully provided for out of the fees received from members for analyses, and such fees under the proposed scale would be low enough to bring the services of the chemist within the reach of the smallest foundries. He doubted if there was a foundry so small that it would not be benefited by at least two determinations each week. The equipment of the laboratory and expense attaching to the same would require about $1,900, and it was thought that determinations could be made at a cost not exceeding $1 each. From the experience obtained from those who already used chemistry in their business he thought it was fair to say that every dollar expended in determinations would bring results worth the expenditure many times over. The value of a membership in the association would be considerably increased by the establishment of a laboratory, and the roll of membership receive many additional names.

XUM

Thos. Devlin approved of the plan. He said that the services of a chemist are not to be connected entirely with the analysis of pig irons. A chemist is regularly employed in the establishment of Thos. Devlin & Co., and besides making determinations on pig irons, it was customary to make analyses of everything playing any part in the turning out of a casting. For instance, they had made analyses of a number of foundry facings and the results were quite interesting as proving the difference in quality. One sample showed 50 per cent. of graphite and 46.8 of sand; another 26.8 of graphite and 72.2 sand; another 41.39 graphite and 53.44 sand; another 85.57 graphite and 14.43 sand; and another 72.95 graphite and 22.01 sand. All these facings, he said, were regularly on the market and he presumed some of them were sold a little cheaper than others. Ordinary foundries without facilities for analysis had but little opportunity for detecting inferiority in such supplies. His concern would not do without a chemist even though the work they had for one did not keep him fully employed. The association as a whole, he said, would be very much benefited by a laboratory such as proposed.

J. K. Dimmick also spoke in favor of the scheme. In the course of his remarks he spoke of the differences noticed in analyses, of furnace irons made by outside chemists, in comparison with the regular analyses furnished by the shippers. These differences might be traced to the methods of grading employed by most furnaces and which were very conducive to error. In this direction he thought an association laboratory would prove exceedingly beneficial.

Mr. Devlin, in some further remarks in regard to furnace analyses, stated that his firm had corrected the furnace analyses of the entire charcoal iron production of this country. They had found the furnace analyses of these irons very incorrect. In some of them the sulphur was put entirely too low, while careful anlysis proved it was entirely too high. The cause was found in the limestone which was being used, and the trouble, after considerable expenditure, was corrected. Although the analyses made by the chemist of his concern were contested they were sustained, on reference to some of the highest authorities in the country, and the errors admitted.

XUM

The movement was also endorsed by Messrs. Flagg, Pfahler, Outerbridge, and others, considerable time being taken up in the discussion. The matter was finally left in the hands of the executive committee for further action.

Geo. C. Davis presented by the aid of a lantern slide the following table illustrating the use of analyses in making mixtures:

**GRAY.**

| Brand. | Sil. | Sulph. | Phos. | Mang. | Graph. | C. Carb. |
|---|---|---|---|---|---|---|
| A | 3.81 | .038 | .43 | .21 | 3.13 | .08 |
| B | 2.23 | .024 | .29 | .68 | 2.57 | .52 |
| C | 2.26 | .018 | 1.15 | .58 | 2.69 | .43 |
| Sprue. | 2.50 | .060 | .75 | .30 | 3.00 | .20 |
| 30% A | 1.143 | .0114 | .129 | .063 | .939 | .024 |
| 20% B | .446 | .0048 | .058 | .136 | .514 | .104 |
| 10% C | .226 | .0018 | .115 | .058 | .269 | .043 |
| 40% Sp. | 1.000 | .0240 | .30 | .120 | 1.200 | .080 |
| | 2.815 | .0420 | .602 | .377 | 2.922 | .251 |

**MALLEABLE.**

| Brand. | Sil. | Sulph. | Phos. | Mang. | Graph. | C. Carb. |
|---|---|---|---|---|---|---|
| D | 1.19 | .031 | .13 | .51 | 3.42 | .54 |
| E | .39 | .017 | .20 | .21 | 2.73 | 1.29 |
| Sprue. | .60 | .065 | .15 | .30 | .20 | 3.00 |
| 50% D | .595 | .0155 | .065 | .255 | 1.710 | 2.70 |
| 10% E | .039 | .0017 | .020 | .021 | .273 | 1.29 |
| 40% Sp. | .240 | .0260 | .060 | .120 | 0.80 | 1.200 |
| | .874 | .0432 | .145 | .396 | 2.063 | 1.599 |

A paper by E. B. Gilmore, Milwaukee, on "The Burning or Mending of Castings," was then presented. I. L. McCord, of the Maywood Foundry & Machine Co., Chicago, Ill., presented a paper on "Machine Molding." Copies of the paper furnished by The Iron Trade Review having been distributed to members, its reading, owing to the lateness of the hour, was omitted. Mr. McCord showed several lantern slides of the company's different machines and explained their uses in various kinds of service.

After adjournment a lunch was served in the roof garden of the club.

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION, NOV. 7, 1900.

*The Iron Trade Review*, Nov. 15th. The entire session of the monthly meeting of the Pittsburg Foundrymen's Association held Wednesday evening, Nov. 7th, at 305 Penn avenue, Pittsburg, was taken up with the discussion of the amendment offered to the constitution providing for the membership in the American Foundrymen's Association of every member of the local body. Prior to the meeting Secretary Zimmers sent out notices of the proposed amendment, together with postal cards upon which members who could not attend the meeting could express their opinion on the matter. However, it was found that no definite action could be taken upon the amendment at the meeting since the constitution provides that an amendment offered at one meeting cannot be voted upon until the next regular meeting and that a two-thirds vote of the members of the association is required to amend the constitution.

The executive committee in its report suggested that the dues of all the members be increased to $10 per year instead of $6 as they are paying at present. Of this increased amount, $5 is to be paid to the national organization for membership therein and the remaining $5 is to go to the support of the local organization. The recommendations of the committee were discussed at length. The matter was argued pro and con, and it was the opinion of those present that nothing should be done that would in any way injure the membership of the local body. It was contended by some that by increasing the membership fee some of the present members might drop out altogether, thus making the local body a loser. This in fact seemed to be the main objection to the amendment offered. However, despite these objections, an amendment was offered providing for increasing the fee to $10 per year, thus making membership in the local body carry with it membership in the National Association, which at present is optional.

The matter is an important one and it was stated at the meeting that the other associations throughout the country are waiting for the Pittsburg organization to act before taking the step themselves. That the membership of the American

XUM

Foundrymen's Association should be increased immediately was not denied by any of those present but the method of making such increase brought forth much discussion.

It was reported that the entertainment fund still in the hands of the entertainment committee from the foundrymen's convention held in Pittsburg last year was used for printing 1,000 extra copies of the papers sent out this month. These will be sent to foundrymen throughout the country and particularly in sections in which there is some possibility of organizing a local association. It is believed that in this way the membership of the national body can be increased and if additional locals can be organized it will mean staunch support for the national body.

Secretary Moldenke, of the American Foundrymen's Association, reported that the other locals in the country are awaiting the action of the Pittsburg association with reference to joining the American Association in a body before taking action. Of course if the Pittsburg association refuses to act favorably it is not probable that the other locals will consider the matter at all, and the very existence of the American Foundrymen's Association will then be at stake. At the next meeting of the association the amendment offered will be voted upon and a full attendance is asked in order that a fair expression upon the matter can be obtained. Voting blanks will be sent to all members unable to attend, so that their sentiments may be recorded.

---

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION, DEC. 5, 1900.

*The Iron Trade Review*, Dec. 13th. An initial step has been taken by the Pittsburg Foundrymen's Association to bring about a closer relationship between the American Foundrymen's Association and the local foundrymen's associations throughout the country. At the monthly meeting held at Pittsburg, Wednesday evening, Dec. 5th, it was decided by an almost unanimous vote to apply for membership in the American Foundrymen's Association in a body. The dues were also increased from $6 per year to $10, the increase paying for the membership in the

national association. The amendment to the constitution decided upon is as follows:

Article IV., Section 1: "Each person, firm or corporation elected to membership in this association, except honorary members, shall pay to the association the sum of $10 in advance annually, which amount shall include a membership in the American Foundrymen's Association." Section 2 shall be stricken out. Section 3: "No dues or assessments of any kind shall be collected from honorary members."

Secretary Zimmers was requested to notify all the other local associations throughout the country of the action taken at this meeting and to invite their co-operation in carrying out the movement already started. It is the intention of the prime movers in the above action to bring about the closer affiliation between the national body and the locals before the next annual convention is held; and from word already received from other locals it is believed that the action of the Pittsburg association will meet their views and lead to a similar step.

For every membership in the Pittsburg Association, honorary excepted, the American Association receives $5 per year, payable to the secretary of the Pittsburg local. This action increases the membership in the American Foundrymen's Association by more than three-score. Should all the other local associations take similar action the present membership of the national association will be nearly doubled, strengthening the organization materially and greatly adding to its usefulness. There is little fear that any of the present members of the Pittsburg association will drop their membership owing to the increased dues. Those who have been wavering have received samples of the educational literature that is being distributed by the American Foundrymen's Association and have concluded that the information contained therein is well worth the increase in the membership dues.

At the conclusion of the business session the paper prepared by E. H. Putnam, of Moline, Ill., entitled, "Shot Iron: How to Recover It, and How to Use It," was read by Secretary Zimmers and discussed at some length.

XUM

## PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA, DEC. 5, 1900.

*Iron Age*, Dec. 13th. A large and representative attendance was present. The executive committee made a report on the matter of the association's proposed laboratory, by which Mr. George C. Davis, a chemist, was allowed to use the name of the association in establishing a chemical laboratory, in return for which members would get special discounts on work done by him. Mr. Davis announced that the laboratory would be open for business Dec. 15, 1900, and would be located at 35 S. 10th St., Philadelphia, Pa.

The executive committee reported that the incorporation of the association would not be possible under its present constitution, and this matter was therefore dropped. The paper of the evening, on "Shot Iron, How to Recover It, and How to Use It," by Mr. E. H. Putnam, was read by Mr. F. H. Finlay, of Moline, Ill., in the absence of the author. Mr. Finlay also explained the magnetic separator fully and exhibited samples of separated shot. Messrs. Flagg, Williams, Pessano and Evans discussed the paper, and the members and visitors adjourned to the roof garden, where Mr. F. H. Thomas, of Los Angeles, Cal., was introduced to the members, and speeches brought the social session to a close.

---

## PROCEEDINGS OF THE AMERICAN SECTION INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS.

### Annual Meeting, Oct. 25 to 27, 1900.

As the American Foundrymen's Association is a member of this important body and we are especially interested in the work being done by it in the lines relating to cast iron and cast steel, the proceedings given herewith may be of value. We are indebted to Mr. P. Krenzpointer for the following, your secretary being prevented from attending the session regularly. He called attention, however, to the important work the A. F. A. is doing for the trade at large, in seeking to elevate the standard of the work produced and thus meet the demands made upon us by

the heavy buying interests. From the great interest observed in our work, and the pressing requests for our specifications of what good cast iron should be, the time will surely come when only concerted efforts will hold much of the trade from drifting into the steel foundries..

As previously announced the meeting was held at the House of the American Society Mechanical Engineers, 12 W. 31st St., New York. The meeting was called to order at 3 P. M., Thursday, October 25th, by the president of the section, Prof. Merriman. After a few appropriate remarks by the chairman the various officers and committees were called upon for their respective reports.

The secretary reported 163 members.

The treasurer reported a balance on hand of $21.54.

The publication committee reported an expenditure of $772.00 for publication and research.

The executive committee reported on the various correspondences carried on during the year, concerning the American representation to the International Council of the association.

An amendment to the constitution was offered to have the president of the section be ex-officio the American member of the International Council. This amendment was adopted at one of the meetings of the following day.

At the election for officers for 1900-1902 there were chosen:

President ..... Prof. Henry M. Howe, New York
Vice-President ..... Dr. Charles B. Dudley, Altoona
Secretary ..... Prof. James M. Porter, Easton
Treasurer ..... William H. Lesley, Philadelphia
Member of Council ..... Prof. H. M. Howe

The number of votes cast and legal, 90, were unanimously in favor of the candidates with the exception of one vote cast for Mr. Webster for president.

Following the afternoon session the members present enjoyed an informal dinner.

At the evening session Com. No. 1, International Specifications, submitted their proposed specifications for Structural Steel for Buildings, Structural Steel for Bridges and Ships and Open-Hearth Boiler Plate and Rivet Steel. After an animated

discussion of these specifications by a number of the members present they were adopted for recommendation to the international committee.

At the morning session and the afternoon and evening sessions of the 26th of October the specifications for Steel Axles, Steel Tires and Steel Forgings, for Steel Rails, Steel Splice Bars, Steel Castings and Wrought Iron were more or less thoroughly discussed. The specifications for Axles, Tires, Forgings and Steel Castings and Wrought Iron were referred back to the committee for revision and amendment.

At the morning session of the 27th the committee on Impact Tests, on Basic and Open-Hearth Steel, on Proper Heat Treatment of Iron and Steel, on the relation between the Physical and Chemical Properties of Iron and Steel, and on the Electric Testing of Metals, made their respective reports.

All the sessions were marked by a delightful degree of harmony, mutual courtesy and tolerance, notwithstanding the views of the producers and consumers sometimes were radically opposed to each other at times and clashed more or less as was evinced by the very animated and most interesting discussions carried on by the financial and technical experts of the varying interests represented.

The meeting adjourned Saturday, the 29th, at 1 P. M.

---

## DISCUSSION ON MR. WILLIAMS' PAPER ON "ELECTRIC TRAVELING CRANES."

*Tin and Terne*, Oct. 18th. In opening the discussion, Mr. S. D. Sleeth stated that the subject of electric cranes was an important one, as they were coming into very general use. Part of their popularity is due to the fact that electric plants in connection with manufacturing establishments are becoming very common in order to supply light and often power also for running various kinds of machinery. The electric plant being necessary in any case, it is natural to extend its usefulnes by employing one or more electric traveling cranes. Mr. J. S. Seaman brought up the subject of brakes for the bridge travel and asked Mr. Williams to give what points he could on the subject. Mr. Williams stated that there were various forms which could be

readily applied and would stop the bridge, but the difficulty was that, including the load being carried, there was a very heavy weight to be stopped, and the bridge was likely to slide. It is perhaps preferable to stop the bridge in an emergency by reversing the motor. Mr. Seaman stated that he employed a 60-ton crane, which frequently carried a load of from 30 to 35 tons, and it was a pretty dangerous matter to stop it quickly. Mr. Williams pointed out that the existence of the brake was likely to make the operator careless. He uses it too much and gets to depend on it in cases where it is not absolutely needed. He knew of one case where a 60-ton crane had been equipped with a brake, which was subsequently taken off as it was considered dangerous. There was no trouble without it, as the operator ran the crane at a slower speed. He thought it better to have no bridge brake on cranes of over say 25 to 30 tons capacity.

An accident was mentioned as having happened to a crane equipped with a bridge brake, on account of the sidewise pull of the load, which caused the chain to lap on the drum and rub the motor, spoiling it. The crane maker was hardly to blame for the close quarters in this case, because he was continually between the devil and the deep sea, through his desire on the one part to design the machinery so it will run most satisfactorily and give least trouble, and the desire of the customer on the other hand for a maximum of floor space. The latter results in a crowding of the machinery into too small a space. It was mentioned that broken sheaves or a bent shaft frequently resulted from running the hook up too far and catching it in the shaft.

Regarding the recommendation in the paper that the chain be annealed at intervals, Dr. Moldenke inquired how often it was desirable to anneal the chains, and Mr. Williams stated that ordinarily the chains should be annealed once a year, but with heavy service day and night once every six months was by no means too often. The hook should also be annealed, but care should be taken not to get it too hot, as this would be worse than not annealing at all. Dr. Moldenke stated that a good red heat should be right, with very slow cooling afterward. It was important to get the temperature just right. He knew of some pins that had been annealed to 1425°, which was not enough, and they had then been annealed to 1450°, which had been found

XUM

to be all right, the 25° making all the difference in the world.

Cases were cited of the flanges breaking off the wheels on the runway, this being caused by the wheels not being all the same size. The wheels are made with a chilled tread, to keep down the wear. In a long runway, say 200 feet, a very slight difference in the diameter of the wheels is likely to cause trouble. One of the members speaking of calipering the wheels to see that they were all of the same diameter, it was pointed out that measurement by a steel tape was much preferable. This was not because the steel tape was more accurate in itself, although it is true that the measurement by the steel tape is easier than with the caliper, on account of the care required to have the caliper in the right position, but because it is the circumference of the wheels that should coincide rather than their diameters, the circumference determining the amount of travel per revolution. A wheel might be slightly elliptical and yet work well enough, while one measurement with the caliper would show nothing with respect to this wheel, since it might be made on the major axis of the ellipse, or on the minor axis, and these would be different.

---

## DISCUSSION ON MR. E. H. PUTNAM'S PAPER ON "SHOT IRON: HOW TO RECOVER IT AND HOW TO USE IT."

*The Iron Trade Review*, Dec. 10th, reports the discussion of the meeting of the Pittsburg Foundrymen's Association as follows: A number of those present took exceptions to some of the statements contained in the paper, and it was the almost unanimous opinion that the labor entailed in recovering the shot iron and its subsequent effects on the heats in which it is untilized by no means netted the profit claimed by Mr. Putnam; if anything, those who expressed themselves concluded that its recovery and use really entailed a loss.

One of the foundrymen stated that if a satisfactory and cheap method of recovering the shot iron could be devised it would probably mean a saving in some foundries, but he detailed a number of experiments he had made, in which the value of the iron recovered did not pay for the labor entailed by its

recovery. It one experiment he succeeded in recovering 1,500 pounds of shot iron from a heat of 100 tons. This was subsequently melted in a small cupola and cast into pigs. The result was that only 500 pounds of metal was poured and the pigs were not even mottled, as claimed by Mr. Putnam. The molten iron was as white as molten steel and not a drill in the machine shop was sufficiently hard to make an impression on it. In recovering the iron the refuse was thrown into a tumbling barrel, in the way outlined in Mr. Putnam's paper, and water barrels were utilized in recovering the particles of iron, the iron dropping to the bottom of the barrels and the lighter particles passing off with the water. The method of recovering the particles by magnetic separation, as used by Mr. Putnam, had not been tried by any of the foundrymen taking part in the discussion.

The question of the hardening of the recovered iron came up and it was explained that re-melting burnt practically all the silicon out of it, owing to the very small size of the particles. To prevent the hardening of this iron one of the foundrymen explained that he had tried very slow firing, but had found that the method was too costly and that the iron was not very much softer than that recovered by ordinary firing.

Some time ago the question of recovering this hot iron was the cause of considerable controversy and it was suggested that it be boxed up in a wooden box and charged into the cupola in that manner to prevent the small particles from being blown out by the blast when applied. This was tried by one of the foundrymen, who stated that he could find no trace of the iron in the heat and subsequently had cast iron boxes made in which turnings and borings were placed, as well as small particles of iron recovered from the tumbling barrel. This experiment also proved worthless, as no trace of the iron thus placed into the cupola could be subsequently found, utmost care having been taken in weighing the charge and the iron poured from the cupola. He then concluded that further experiments would do little good and is making little or no effort at present to recover the shot iron. At his foundry he stated that the turnings are very large, but has not as yet succeeded in finding a method of remelting them. All turnings and borings from the machine shop instead of finding their way back into the cupola

XUM

are sold at a low figure to mills which use them for puddling purposes.

Exceptions were taken to the statements made by Mr. Putnam with reference to the value of the iron recovered. He places it at 67c a hundred pounds, or about $15 per gross ton. It was the expressed opinion that the iron, on account of its hardening effect, is not worth more than $5 a ton. Although Mr. Putnam did not state the cost of installing his plant it was roughly estimated that it could not be had for less than $1,000. To this must be added power utilized and labor, together with the great risk of securing hard castings, which would entail a greater loss at one heat than the value of all the iron recovered for a number of months.

Of the Foundrymen's Association in Philadelphia, Pa., the same journal writes:

Mr. Pessano said that in the foundry of the Geo. V. Cresson Co. shot iron was used in charging the cupola, but he believed a large percentage of it might be found on the roof, driven out by the blast.

As an instance of the saving effected by separation from refuse Mr. Findley said that his concern built a three-story building last summer and every bit of the iron that went into it was made from the slot iron obtained in their foundry. The cupola stack was 25 to 30 feet high.

Asked by Mr. Davis whether 67 cents was not a pretty high figure for shot iron, Mr. Findley said he did not think so. While in his section scrap iron was worth $10 to $12, in New York he found they were paying $14. As a rule he had figured it at $10 per ton.

Mr. Flagg assumed that in using the shot iron the proportion of No. 1 pig was increased, in which case the difference in the cost would have to go against the saving effected in the use of the shot. He thought a cupola would choke up if much shot iron were used; in fact, he had seen the blast in his foundry run up three pounds when it was used. The shot, however, it should be said, was charged in carelessly. He eventually charged it in wooden boxes and the difficulty was removed.

Mr. Findley quoted the figures furnished him by a foundryman who he said kept a close account of the iron going into his

cupola, and the output of castings, and by saving all the waste the figures in cases came within three per cent. difference.

Aug. Williams asked whether the machine would take the scrapings of the floors, and Mr. Findley said they threw everything that comes from the floors into the machine. At a recent test of the machine in a New York foundry two wheelbarrow loads of scrapings were put through the machine, and from one 33 pounds of iron was obtained, and from the other 31 pounds.

Mr. Williams thought there might be some economy where the cupola attendants looked after the waste, but in the general savings of a foundry other labor had to be called in which would tend to diminish the profit from the proceeding very materially.

*The Iron Trade Review*, Dec. 20, 1900.

Mr. Putnam writes in reply to the criticisms on his paper as follows:

I note that Mr. Pessano "believed that a large percentage of it [shot iron charged into the cupola] might be found on the roof, driven out by the blast."! [The exclamation point used here is not in the original report.] Since it is a part of my regular business to advise foundrymen how to do their work, I will here suggest that Mr. Pessano reduce the force of the blast sufficiently to insure the retention of the iron in the cupola until it shall find its way out at the tap hole. The iron melts at a point considerably above that at which the blast enters the cupola. Query: If the blast is strong enough to blow a "large percentage" of solid masses of iron out of the cupola stack, how does the molten iron escape a similar fate? Mind, I do not deny the phenomenon, but where it occurs I advise a diminution of blast pressure.

"Mr. Flagg assumed that in using the shot iron the proportion of No. 1 pig was increased, in which case the difference in cost would have to go against the use of the shot." If Mr. Flagg's assumption be granted, his conclusion will follow inevitably. But, where did Mr. Flagg get his premise? I must confess that his experience in melting shot iron, as described by himself, was calculated to discourage. And I will not deny that if I were to so charge my cupola with shot iron as to "choke it up," I should form a bad opinion, either of shot iron generally—or of my cupola practice. (I will say, in parenthesis, that my present opinion of

XUM

shot iron is rather better than it was when the paper under discussion was written, several months ago.) I am glad to note in this connection that Mr. Flagg adds that, in his experiment the shot was charged in carelessly. His experiment then, having been conducted without skill, is no criterion.

At the Pittsburg meeting: "One of the foundrymen" stated that in an experiment which he conducted only 500 pounds of very hard, white fractured pigs was produced from 1,500 pounds of shot iron charged! He also must have used a very strong blast. He does not state what he cleaned up from the foundry roof after the heat, however. I infer that his cupola (save as to the lining) remained on its legs.

Another anonymous participant in the debate averred that the outcome of shot iron charged into his cupola was simply zero.

To offset this, and other criticisms I have to state that I charged into a small cupola, loosely, just as would be done with any ordinary scrap iron, a certain ascertained weight of shot iron, and the product (including about 5 per cent. of the charge, recovered from dump, after the heat) was 90 per cent. of the charge. Every day now, and for many months past, I have been using all of the shot iron made in all the processes of our foundry, without the slightest increased cost of pig iron used in the mixture, and have never, save on one occasion, had any trouble from hardness, or other physical or chemical fault, in the product. On the occasion excepted, it developed that the fault lay in the No. 2 foundry pig.

With regard to the price that I credited to shot iron, I will say that my paper was written long ago, and had been lying in the hands of the associations for reading in its turn. At that time we had just closed our season's work, and had not gone into the market for this year's supply of stock. Much of last year's stock of pig iron brought considerably more than $20 per ton. Under those conditions, and the shot iron yielding 90 per cent., and being used without changing per cent. of pig iron and scrap, and without employing a higher-priced pig, it seems to me that the shot was worth about as was stated. To-day, it is not worth so much, of course. But that is a fault of the market. and not of the shot iron.

## DISCUSSION ON MR. MUMFORD'S PAPER ON "THE PROBLEM OF MACHINE MOLDING."

Mr. E. H. Putnam says the following in the "Tradesman" of October 1st: That the various designs of moulding machines may be profitably used in the foundry is beyond doubt. The ill-success attending their introduction in many instances cannot in fairness be ascribed to impracticability of the machine itself, but rather it must be charged to inefficiency in operation. But this does not tell the whole story. The primary cause of failure lies back of this, and is manifold in character.

First and foremost the vendor of the machine has habitually claimed too much for it. He has raised the expectations of the prospective buyer to a point far above practical realization. I pointed out this fact some years ago in a newspaper article; and the position that I then took is corroborated by the testimony of men who have made a success of using machines. At the meeting of the Pittsburg Foundrymen's Association, Sept. 5, a paper on "The Problem of Machine Molding" was read, and several members objected to the assertion that the machines could be successfully operated by unskilled labor. It was admitted that the machines could be operated by this class of labor, but that the work had to be poured off by competent molders.

"One of the foundrymen stated that he was compelled to press his molders, engaged on work that could not be done by the machine, into service at pouring off time. The results were, however, far from satisfactory. Many strained castings were made and the proportion was found to be greater than in hand molding. The reason for this was that the unskilled laborers operating the machines did not know how to pour off, and it was intimated that the molders pressed into service, not taking kindly to the molding machines, did not use their best efforts to produce perfect castings."

This is, in its entirety, no doubt true. And the reason for the molder's inveterate enmity toward the machine is not far to seek. The seller of the machine places it in the shop, averring that it will save 50 per cent. in cost of molding. The molders in that shop know that it cannot possibly do anything of the kind. But they know at the same time that their employer expects it to do that, on the strength of the seller's word. The

XUM

molder knows, furthermore, that if he consents to operate the machine, and shall fail to make it do something near what is expected, he will be denounced by the vendor, and that he will be urged to greater and greater effort to make good the word of the exploiter of the machine. But, as this is entirely beyond his power, he probably quits in disgust.

Who is at fault in this case? Not always the employer. In fact, often, the employer has no practical knowledge of molding; in which case he is obliged to depend upon the word of others. And he will naturally take the word of the machine vendor in preference to that of the molder, partly because he thinks his interest lies that way, and partly because the molder generally, and naturally, is averse to the introduction of the machine, and therefore is not a disinterested witness. Another circumstance which misleads the employer very often is the fact that his foundry foreman, who is an experienced molder, sanctions the claims made for the machine. Why shouldn't he? You cannot expect him to sacrifice his position to a disposition to tell just what he thinks, when he knows that, in such case, the vendor will, on some convenient occasion, remark to his employer that "it is extremely unfortunate that his foundry foreman should entertain such an aversion to the employment of labor-saving devices."

The result is that, in some instances, the founder fails to get the benefit of his foreman's candid opinion.

There are circumstances under which it is a comparatively easy matter to poison the mind of an ordinarily generous man against another. And the circumstances under consideration are of this kind. The foreman, therefore, well knowing that more is expected than can be accomplished, goes forward in the performance of his duties in general, doing the best he can, and suffering what he must.

Every man who knows the situation in foundries generally will admit that the molders do, as a rule, a good big day's work. He knows also that the part of the day's work which consists of pouring the molds is of a very arduous character, keeping the workmen very busy. To be called upon at this juncture to pour off, additionally, the floors of a lot of laborers who have been operating machines, is a species of distinction which not many

of them will regard with any marked favor. This may be a matter of surprise to some employers, but it is nevertheless a fact; and facts are what we have to deal with. I confess that, for my own part, I cannot quite understand this feeling on the molder's part. Why a man who, after shoveling sand and molding for seven hours, and, during the next two or three hours, has poured off anywhere from twelve to thirty-six ladles of iron, should not take especial delight in pouring off another floor while he is resting, preparatory to shaking out and shoveling up, is rather more than I can comprehend! But some people are extremely perverse.

Another foundryman, who has had wide experience with the casting of malleable iron, stated that it was a very hard matter to secure molders accustomed to working gray iron to pour the malleable iron, for the reason that it seems hotter to the men than gray iron when it is poured, while just the reverse is true; it also has the dazzling whiteness of molten steel."

It may be also said that in pouring certain classes of gray iron work with the highest success a very high order of skill is necessary. More than this; constant daily practice is important. The molder who is accustomed to only heavy work must practice a number of days before he is fit to pour successfully the light castings often made on the machines. The green hand is totally unfit to pour iron where any skill whatever is demanded, and he can never acquire the skill except by practice. If we could get a machine that would pour the iron, it would simplify matters materially. If we could get machines to do everything, we could discharge all of our workmen—but it would be rather lonesome in the shop!

Meantime, let us see to it that we employ machines where they can be profitably used, and that we insist upon getting out of them everything possible—that we make the machine do all that it can be made to do, and that we endeavor to refrain from calling upon the workmen who are not working with the machine to do a lot of additional work and credit it to the machine. If you want them to do additional work, ask them to do it, and pay them for doing it. Your workman is exactly the same as yourself in this respect. You are not in the habit of giving away castings, and he is not in the habit of giving away labor.

XUM

And in this you are both perfectly right. The workman who is asked to employ his skill gratis realizes the situation, and resents it mentally, if he does not dare to voice it. And this resentment may manifest itself in strained castings, if he is made to pour off the machine man's work. But the strained castings may be, on the other hand, simply unavoidable. In shops where the molders work by the piece, and do big days' work, the pouring of a single floor may so exhaust the strength of the workman as to render perfect control of the ladle impossible. Every foundry foreman, who is himself a practical molder, knows this to be a fact. Therefore, the molder may be unjustly suspected of indifference in his work of pouring on another man's floor.

Of course, I do not mean to say that the molders generally are free from blame in their attitude toward the machine. Far from it. On the contrary, the molder is, and has been, his own worst enemy in this respect. He ought to take the machine and make it do all that it can do. If he does not, somebody else will. The foundry world is not going to halt and stand still to gratify the molder, or anybody else. As a matter of fact, it is well known that molders frequently do much less work on the machine than can be produced by common labor. This sort of canduct may "go" for a time; but it will lead to disaster to the offender in the end.

We are using, in the foundries where I am employed, twenty-four machines. We have no difficulty of any kind.

There is a very considerable saving in cost of molding, and a great gain in quality of castings. Each man operates his own machine and pours off his own work. No other way than this is practicable. So soon as you divide the responsibility for the quality of the work, nobody is at fault for bad work. It is sufficiently difficult to get perfect product when each man is fully responsible for a given piece of work.

An important matter to be borne in mind is the fact that it will not pay you to introduce any, even the simplest form of machine, unless you have much of the class of work that fits its capacity. Foundries that make a very large output of light castings can develop the utility of the machine to the highest degree; and here the economies possible are great and correspondingly important.

XUM

# PROCEEDINGS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

**Progress Report of the Committee on Standardizing the Testing of Cast Iron.**

## CAST G—CAR WHEEL IRON.

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardizing the testing of Cast Iron, furnished 90 tests.

Cast G illustrates a class of castings which must resist abvasion, and, at the same time, successfully encounter suddenly applied heat. Again that portion which is not chilled must be soft enough to machine readily. The American car wheel is the best example.

The bars were made by the secretary and were presented to the committee in the interest of the trade.

The analysis of the one inch dry and square bar is as follows:

| | |
|---|---|
| Total Carbon | 4.17 |
| Graphite | 3.43 |
| Silicon | .97 |
| Manganese | .40 |
| Phosphorus | .301 |
| Sulphur | .06 |

The fluidity strip ran up full and the chill was about five-eighths inch deep. The mixture contained cold and warm blast charcoal irons, some coke iron, scrap steel, and scrap car wheels.

Series G.

**TABLE NO. 1.**

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Green Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Size. Depth Ins. | Actual Size. Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1112 | 0.5x0.5 | .50 | .50 | 440 | .140 |
| 1113 | 1x1 | 1.01 | 1.00 | 2,670 | .125 |
| 1114 | 1.5x1.5 | 1.49 | 1.51 | 5,980 | .120 |
| 1115 | 2x2 | 2.00 | 2.00 | 15,760 | .110 |
| 1116 | 2.5x2.5 | 2.51 | 2.54 | 27,660 | .090 |
| 1117 | 3x3 | 3.02 | 3.02 | 49,040 | .070 |
| 1118 | 3.5x3.5 | 3.50 | 3.51 | 68,990 | .070 |
| 1119 | 4x4 | 4.00 | 4.04 | 87,010 | .065 |

XUM

## TABLE NO. 2.

Series G.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Green Sand and Machined.

| Square Bar. No. | Approx. Original Cross Section Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1120 | 1X1 | .5X.5 | 300 | .190 |
| 1121 | 1.5X1.5 | 1X1 | 2,480 | .180 |
| 1122 | 2X2 | 1.5X1.5 | 5,160 | .175 |
| 1123 | 2.5X2.5 | 2X2 | 13,770 | .160 |
| 1124 | 3X3 | 2.5X2.5 | 24,940 | .150 |
| 1125 | 3.5X3.5 | 3X3 | 46,330 | .140 |
| 1126 | 4X4 | 3.5X3.5 | 62,100 | .125 |

## TABLE NO. 3.

Series G.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1127 | 0.5X0.5 | .51 | .52 | 400 | .140 |
| 1128 | 1X1 | .99 | 1.00 | 2,440 | .120 |
| 1129 | 1.5X1.5 | 1.54 | 1.51 | 5,610 | .120 |
| 1130 | 2X2 | 2.00 | 2.01 | 14,380 | .090 |
| 1131 | 2.5X2.5 | 2.51 | 2.51 | 28,130 | .085 |
| 1132 | 3X3 | 3.03 | 3.02 | 49,500 | .075 |
| 1133 | 3.5X3.5 | 3.52 | 3.52 | 72,060 | .075 |
| 1134 | 4X4 | 4.02 | 4.00 | 88,770 | .060 |

## TABLE NO. 4.

Series G.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Dry Sand and Machined.

| Square Bar. No. | Approx. Original Cross Section Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1135 | 1X1 | .5X.5 | 320 | .200 |
| 1136 | 1.5X1.5 | 1X1 | 2,260 | .180 |
| 1137 | 2X2 | 1.5X1.5 | 4,880 | .175 |
| 1138 | 2.5X2.5 | 2X2 | 12,370 | .150 |
| 1139 | 3X3 | 2.5X2.5 | 25,140 | .135 |
| 1140 | 3.5X3.5 | 3X3 | 42,900 | .130 |
| 1141 | 4X4 | 3.5X3.5 | 66,070 | .120 |

XUM

Series G.

## TABLE NO. 5.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Green Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Size Depth $d$ Ins. | Actual Size Width $d$ Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1142 | 0.56 | .55 | .54 | 420 | .130 |
| 1143 | 1.13 | 1.12 | 1.14 | 2,450 | .125 |
| 1144 | 1.69 | 1.69 | 1.70 | 7,290 | .110 |
| 1145 | 2.15 | 2.15 | 2.13 | 14,880 | .100 |
| 1146 | 2.82 | 2.80 | 2.86 | 26,470 | .105 |
| 1147 | 2.82 | 2.83 | 2.85 | 27,560 | .090 |
| 1148 | 3.38 | 3.39 | 3.38 | 47,810 | .080 |
| 1149 | 3.95 | 3.97 | 3.98 | 70,550 | .080 |
| 1150 | 4.51 | 4.50 | 4.50 | 86,100 | .070 |

Series G.

## TABLE NO. 6.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined $d$ Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1151 | 1.13 | .56 | 370 | .200 |
| 1152 | 1.69 | 1.13 | 2,040 | .205 |
| 1153 | 2.15 | 1.69 | 6,570 | .170 |
| 1154 | 2.82 | 2.15 | 12,440 | .140 |
| 1155 | 3.38 | 2.82 | 24,900 | .150 |
| 1156 | 3.95 | 3.38 | 44,130 | .130 |
| 1157 | 4.51 | 3.95 | 60.050 | .120 |

Series G.

## TABLE NO. 7.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Dry Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Size Depth $d$ Ins. | Actual Size Width $d$ Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1158 | 0.56 | .52 | .54 | 380 | .140 |
| 1159 | 1.13 | 1.14 | 1.12 | 2,940 | .135 |
| 1160 | 1.69 | 1.69 | 1.68 | 6,240 | .120 |
| 1161 | 2.15 | 2.16 | 2.17 | 13,000 | .120 |
| 1162 | 2.82 | 2.82 | 2.34 | 24,960 | .105 |
| 1163 | 3.38 | 3.39 | 3.39 | 44,820 | .110 |
| 1164 | 3.95 | 3.97 | 3.98 | 66,550 | .090 |
| 1165 | 4.51 | 4.52 | 4.50 | 81,170 | .070 |
| 1166 | 4.51 | 4.53 | 4.52 | 84,330 | .065 |

XUM

## TABLE NO. 8.

Series G.

TRANSVERSE TEST.

Car Wheel Iron.—Bars in Dry Sand and Machined.

| Round Bar. No. | Approx. Orig. Diam. Ins. | Actual Size as Machined *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1167 | 1.13 | .56 | 300 | .210 |
| 1168 | 1.69 | 1.13 | 2,180 | .180 |
| 1169 | 2.15 | 1.69 | 5,900 | .170 |
| 1170 | 2.82 | 2.15 | 11,740 | .170 |
| 1171 | 3.38 | 2.82 | 20,580 | .150 |
| 1172 | 3.95 | 3.38 | 40,000 | .140 |
| 1173 | 4.51 | 3.95 | 63,390 | .130 |

## TABLE NO. 9.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Green Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1174 | .5x.5 | .26 | 7,600 | 29,230 |
| 1175 | 1x1 | 1.05 | 24,430 | 23,270 |
| 1176 | 1.5x1.5 | 2.28 | 43,440 | 18,100 |
| 1177 | 2x2 | 4.02 | 60,090 | 14,950 |

## TABLE NO. 10.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Green Sand and Machined.

| Square Bar. No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1178 | 1x1 | .25 | 7,010 | 28,040 |
| 1179 | 1.5x1.5 | 1.00 | 23,600 | 23,600 |
| 1180 | 2x2 | 2.25 | 39,720 | 17,650 |

## TABLE NO. 11.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Dry Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Area in Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq In. Lbs. |
|---|---|---|---|---|
| 1181 | .5x.5 | .26 | 7,480 | 28,770 |
| 1182 | 1x1 | 1.04 | 21,820 | 20,980 |
| 1183 | 1.5x1.5 | 2.26 | 40,550 | 17,940 |
| 1184 | 2x2 | 4.03 | 54,200 | 13,450 |

## TABLE NO. 12.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Dry Sand and Machined.

| Square Bar. No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1185 | 1x1 | .25 | 6,900 | 27,600 |
| 1186 | 1.5x1.5 | 1.00 | 22,400 | 22,400 |
| 1187 | 2x2 | 2.25 | 37,410 | 16,630 |

## TABLE NO. 13.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Green Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Area in Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq In. Lbs. |
|---|---|---|---|---|
| 1188 | .56 | .24 | 7,440 | 31,000 |
| 1189 | 1.13 | 1.01 | 26,830 | 26,560 |
| 1190 | 1.69 | 2.28 | 44,100 | 19,340 |
| 1191 | 2.15 | 4.04 | 62,760 | 15,530 |

## TABLE NO. 14.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Green Sand and Machined.

| Round Bar. No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs |
|---|---|---|---|---|
| 1192 | 1.13 | .25 | 6,770 | 27,080 |
| 1193 | 1.69 | 1.00 | 24,480 | 24,480 |
| 1194 | 2.15 | 2.25 | 40,060 | 17,810 |

## TABLE NO. 15.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Dry Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Area in sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1195 | .56 | .28 | 8,510 | 30,390 |
| 1196 | 1.13 | 1.04 | 24,340 | 23,400 |
| 1197 | 1.69 | 2.29 | 41,970 | 18,330 |
| 1198 | 2.15 | 4.02 | 58,140 | 14,460 |

## TABLE NO. 16.

Series G.

TENSILE TEST.

Car Wheel Iron.—Bars in Dry Sand and Machined.

| Round Bar. No. | Approx. Orig Diam. Ins. | Area as Machined Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1199 | 1.13 | .25 | 6,490 | 25,960 |
| 1200 | 1.69 | 1.00 | 20,200 | 20,200 |
| 1201 | 2.15 | 2.25 | 38,650 | 17,180 |

XUM

## CAST H—STOVE PLATE IRON.

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardizing the testing of cast iron, furnished 88 tests.

Cast H illustrates a class of casting which must approximate thin smooth and if necessary highly ornamental plates. The American Stove and European Art Castings are the best examples.

The bars were made by the secretary and were presented to the committee in the interest of the trade.

The analysis of the one inch dry sand square bar is as follows:

| | |
|---|---|
| Total Carbon | 3.41 |
| Graphite | 3.08 |
| Silicon | 3.19 |
| Manganese | .38 |
| Phosphorus | 1.160 |
| Sulphur | .084 |

The fluidity strip ran up full and showed the finest blemishes of the mold. The mixture contained high phosphorus irons and scrap stove plate.

### TABLE NO. 1.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Green Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1202 | 0.5x0.5 | .49 | .50 | 530 | .170 |
| 1203 | 1x1 | 1.00 | 1.01 | 1,570 | .145 |
| 1204 | 1.5x1.5 | 1.50 | 1.50 | 4,680 | .120 |
| 1205 | 2x2 | 2.01 | 2.02 | 12,690 | .130 |
| 1206 | 2.5x2.5 | 2.53 | 2.51 | 22,900 | .120 |
| 1207 | 3x3 | 3.01 | 3.01 | 38,820 | .110 |
| 1208 | 3.5x3.5 | 3.56 | 3.52 | 48,620 | .100 |
| 1209 | 4x4 | 4.04 | 4.03 | 68,970 | .090 |

XUM

## TABLE NO. 2.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Green Sand and Machined.

| Square Bar. No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1210 | 1x1 | .5x.5 | 340 | .210 |
| 1211 | 1.5x1.5 | 1x1 | 1,250 | .200 |
| 1212 | 2x2 | 1.5x1.5 | 4,320 | .190 |
| 1213 | 2.5x2.5 | 2x2 | 10,710 | .165 |
| 1214 | 3x3 | 2.5x2.5 | 20,580 | .140 |
| 1215 | 3.5x3.5 | 3x3 | 34,440 | .125 |
| 1216 | 4x4 | 3.5x3.5 | 46,700 | .110 |

## TABLE NO. 3.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Dry Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1217 | 0.5x0.5 | .52 | .52 | 400 | .160 |
| 1218 | 1x1 | 1.03 | 1.04 | 1,800 | .140 |
| 1219 | 1.5x1.5 | 1.51 | 1.54 | 5,990 | .130 |
| 1220 | 2x2 | 2.00 | 2.01 | 12,920 | .130 |
| 1221 | 2.5x2.5 | 2.49 | 2.51 | 23,450 | .110 |
| 1222 | 3x3 | 3.03 | 3.00 | 38,640 | .110 |
| 1223 | 3.5x3.5 | 3.56 | 3.52 | 47,980 | .100 |
| 1224 | 4x4 | 4.04 | 4.04 | 66,400 | .095 |

## TABLE NO. 4.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection. Ins. |
|---|---|---|---|---|
| 1225 | 1x1 | .5x.5 | 300 | .220 |
| 1226 | 1.5x1.5 | 1x1 | 1,360 | .200 |
| 1227 | 2x2 | 1.5x1.5 | 4,840 | .160 |
| 1228 | 2.5x2.5 | 2x2 | 10,700 | .180 |
| 1229 | 3x3 | 2.5x2.5 | 20,920 | .145 |
| 1230 | 3.5x3.5 | 3x3 | 36,180 | .130 |
| 1231 | 4x4 | 3.5x3.5 | 44,500 | .120 |

XUM

## TABLE NO. 5.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Green Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Size Depth(d) Ins. | Actual Size Width(d) Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1232 | 0.56 | .57 | .59 | 545 | .130 |
| 1233 | 1.13 | 1.14 | 1.16 | 2,100 | .120 |
| 1234 | 1.69 | 1.71 | 1.71 | 6,900 | .120 |
| 1235 | 2.15 | 2.13 | 2.14 | 12,880 | .105 |
| 1236 | 2.82 | 2.84 | 2.82 | 20,520 | .100 |
| 1237 | 3.38 | 3.38 | 3.39 | 42,360 | .090 |
| 1238 | 3.95 | 3.97 | 4.00 | 64,740 | .090 |
| 1239 | 4.51 | 4.54 | 4.56 | 79,450 | .080 |

## TABLE NO. 6.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Green Sand and Machined.

| Round Bar. No. | Approx. Orig. Diam. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1240 | 1.13 | .56 | 450 | .240 |
| 1241 | 1.69 | 1.13 | 1,570 | .200 |
| 1242 | 2.15 | 1.69 | 5,100 | .180 |
| 1243 | 2,82 | 2.15 | 10,660 | .175 |
| 1244 | 3.38 | 2.82 | 18,740 | .160 |
| 1245 | 3.95 | 3.38 | 39,500 | .140 |
| 1246 | 4.51 | 3.95 | 55,000 | .130 |

## TABLE NO. 7.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Dry Sand and Not Machined.

| Ronnd Bar. No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1247 | 0.56 | .57 | .57 | 420 | .140 |
| 1248 | 1.13 | 1.14 | 1.14 | 1,790 | .120 |
| 1249 | 1.69 | 1.69 | 1.71 | 6,620 | .120 |
| 1250 | 2.15 | 2.14 | 2.16 | 11,960 | .120 |
| 1251 | 2.82 | 2.34 | 2.34 | 19,430 | .110 |
| 1252 | 3.38 | 3.40 | 3.39 | 43,020 | .100 |
| 1253 | 3.95 | 3.97 | 3.97 | 64,800 | .095 |
| 1254 | 4.51 | 4.53 | 4.55 | 77,770 | .090 |

## TABLE NO. 8.

Series H.

TRANSVERSE TEST.

Stove Plate Iron.—Bars in Dry Sand and Machined.

| Round Bar. No. | Approx. Orig. Diam. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1255 | 1.13 | .56 | 400 | .200 |
| 1256 | 1.69 | 1.13 | 1,490 | .200 |
| 1257 | 2.15 | 1.69 | 5,040 | .195 |
| 1258 | 2.82 | 2.15 | 9,100 | .160 |
| 1259 | 3.38 | 2.82 | 16,880 | .140 |
| 1260 | 3.95 | 3.38 | 34,040 | .130 |
| 1261 | 4.51 | 3.95 | 57,070 | .125 |

## TABLE NO. 9.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Green Sand and Not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Area in Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1262 | .5x.5 | .27 | 5,630 | 20,850 |
| 1263 | 1x1 | 1.04 | 15,100 | 14,520 |
| 1264 | 1.5x1.5 | 2.27 | 26,320 | 11,590 |
| 1265 | 2x2 | 4.03 | 41,460 | 10,290 |

## TABLE NO. 10.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Green Sand and Machined.

| Square Bar. No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1266 | 1x1 | .25 | 5,820 | 23,280 |
| 1267 | 1.5x1.5 | 1.00 | 16,440 | 16,440 |
| 1268 | 2x2 | 2.25 | 24,700 | 10,980 |

## TABLE NO. 11.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Dry Sand and not Machined.

| Square Bar. No. | Approx. Cross Sec. Ins. | Actual Area in Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1269 | .5x.5 | .25 | 4,890 | 19,560 |
| 1270 | 1x1 | 1.03 | 15,800 | 15,340 |
| 1271 | 1.5x1.5 | 2.26 | 33,190 | 14,690 |
| 1272 | 2x2 | 4.02 | 40,960 | 11,890 |

XUM

## TABLE NO. 12.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Dry Sand and Machined.

| Square Bar. No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. Ins. | Breaking Strain Lbs | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1273 | 1X1 | .25 | 5,100 | 20,400 |
| 1274 | 1.5X1.5 | 1.00 | 15,420 | 15,420 |
| 1275 | 2X2 | 2.25 | 30,600 | 13,600 |

## TABLE NO. 13.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Green Sand and not Machined.

| Round Bar. No. | Approx. Diam. Ins. | Actual Area in Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1276 | .56 | .25 | 5,440 | 21,760 |
| 1277 | 1.13 | 1.01 | 14,400 | 14,260 |
| 1278 | 1.69 | 2.28 | 34,930 | 15,320 |
| 1279 | 2.15 | 4.03 | 42,770 | 10,610 |

## TABLE NO. 14.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Green Sand and Machined.

| Round Bar. No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. Ins. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1280 | 1.13 | .25 | 5,400 | 21.600 |
| 1281 | 1.69 | 1.00 | 14,920 | 14,920 |
| 1282 | 2.15 | 2.25 | 30,110 | 13,380 |

## TABLE NO. 15.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1283 | .56 | .28 | 4,900 | 17,500 |
| 1284 | 1.13 | 1.03 | 17,620 | 17,170 |
| 1285 | 1.69 | 2.29 | 28,140 | 12,290 |
| 1286 | 2.15 | 4.05 | 41,990 | 10,370 |

## TABLE NO. 16.

Series H.

TENSILE TEST.

Stove Plate Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1287 | 1.13 | .25 | 5,170 | 20,680 |
| 1288 | 1.69 | 1.00 | 16,040 | 16.040 |
| 1289 | 2.15 | 2.25 | 25,500 | 11,330 |

## CAST I—HEAVY MACHINERY IRON.

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardizing the testing of cast iron, furnished 88 tests.

Cast I represents regular machinery iron for heavy work. The mixture contains coke iron, machinery scrap and a little scrap steel.

The bars were made by the secretary and were presented to the committee in the interest of the trade.

The analysis of the one inch dry sand square bar is as follows:

| | |
|---|---|
| Total Carbon | 3.32 |
| Graphite | 2.99 |
| Silicon | 1.96 |
| Manganese | .48 |
| Phosphorus | .522 |
| Sulphur | .081 |

### TABLE NO. 1

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1290 | 0.5x0.5 | .51 | .52 | 350 | .190 |
| 1291 | 1x1 | 1.01 | 1.00 | 2,040 | .170 |
| 1292 | 1.5x1.5 | 1.51 | 1.51 | 6,750 | .160 |
| 1293 | 2x2 | 2.02 | 2.03 | 16,620 | .120 |
| 1294 | 2.5x2.5 | 2.52 | 2.54 | 25,550 | .110 |
| 1295 | 3x3 | 3.00 | 3.01 | 35,900 | .090 |
| 1296 | 3.5x3.5 | 3.56 | 3.59 | 53,470 | .085 |
| 1297 | 4x4 | 4.06 | 4.08 | 67,900 | .085 |

### TABLE NO. 2.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1298 | 1x1 | .5x.5 | 300 | .280 |
| 1299 | 1.5x1.5 | 1x1 | 1,840 | .210 |
| 1300 | 2x2 | 1.5x1.5 | 5,700 | .160 |
| 1301 | 2.5x2.5 | 2x2 | 13,990 | .140 |
| 1302 | 3x3 | 2.5x2.5 | 23,470 | .135 |
| 1303 | 3.5x3.5 | 3x3 | 34,660 | .120 |
| 1304 | 4x4 | 3.5x3.5 | 52,020 | .100 |

XUM

## TABLE NO. 3.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1305 | 0.5x0.5 | .54 | .53 | 390 | .200 |
| 1306 | 1x1 | 1.01 | 1.02 | 2,550 | .160 |
| 1307 | 1.5x1.5 | 1.50 | 1.50 | 6,570 | .150 |
| 1308 | 2x2 | 2.04 | 2.03 | 15,760 | .150 |
| 1309 | 2.5x2.5 | 2.52 | 2.51 | 28,690 | .130 |
| 1310 | 3x3 | 3.03 | 3.03 | 32,280 | .110 |
| 1311 | 3.5x3.5 | 3.54 | 3.52 | 55,260 | .100 |
| 1312 | 4x4 | 4.03 | 4.01 | 68,410 | .090 |

## TABLE NO. 4.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1313 | 1x1 | .5x.5 | 320 | .290 |
| 1314 | 1.5x1.5 | 1x1 | 2,170 | .270 |
| 1315 | 2x2 | 1.5x1.5 | 6,180 | .240 |
| 1316 | 2.5x2.5 | 2x2 | 14,770 | .170 |
| 1317 | 3x3 | 2.5x2.5 | 26,400 | .160 |
| 1318 | 3.5x3.5 | 3x3 | 34,330 | .140 |
| 1319 | 4x4 | 3.5x3.5 | 60,510 | .120 |

## TABLE NO. 5.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth (d) Ins. | Actual Size Width (d) Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1320 | 0.56 | .57 | .59 | 390 | .220 |
| 1321 | 1.13 | 1.12 | 1.14 | 2,490 | .180 |
| 1322 | 1.69 | 1.69 | 1.71 | 7,010 | .140 |
| 1323 | 2.15 | 2.17 | 2.17 | 14,140 | .110 |
| 1324 | 2.82 | 2.84 | 2.85 | 28,110 | .105 |
| 1325 | 3.38 | 3.39 | 3.38 | 42,000 | .095 |
| 1326 | 3.95 | 3.97 | 3.98 | 58,770 | .095 |
| 1327 | 4.51 | 4.53 | 4.52 | 73,400 | .080 |

## TABLE NO. 6.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined D. Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1328 | 1.13 | .56 | 300 | .300 |
| 1329 | 1.69 | 1.13 | 2,120 | .270 |
| 1330 | 2.15 | 1.69 | 6,570 | .240 |
| 1331 | 2.82 | 2.15 | 13,200 | .200 |
| 1332 | 3.38 | 2.82 | 26,440 | .165 |
| 1333 | 3.95 | 3.38 | 40,000 | .125 |
| 1334 | 4.51 | 3.95 | 59,190 | .130 |

## TABLE NO. 7

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth(d) Ins. | Actual Size Width(d) Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1335 | 0.56 | .57 | .57 | 390 | .200 |
| 1336 | 1.13 | 1.14 | 1.15 | 2,650 | .160 |
| 1337 | 1.69 | 1.69 | 1.69 | 7,440 | .160 |
| 1338 | 2.15 | 2.17 | 2.18 | 13,850 | .140 |
| 1339 | 2.82 | 2.82 | 2.81 | 30,110 | .120 |
| 1340 | 3.38 | 3.39 | 3.40 | 45,540 | .105 |
| 1341 | 3.95 | 3.98 | 3.96 | 62,000 | .100 |
| 1342 | 4.51 | 4.51 | 4.51 | 75,770 | .085 |

## TABLE NO. 8.

Series I.

TRANSVERSE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined D. Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1343 | 1.13 | .56 | 320 | .280 |
| 1344 | 1.69 | 1.13 | 2,040 | .250 |
| 1345 | 2.15 | 1.69 | 6,700 | .220 |
| 1346 | 2.82 | 2.15 | 11,650 | .205 |
| 1347 | 3.38 | 2.82 | 27,900 | .185 |
| 1348 | 3.95 | 3.38 | 41,560 | .160 |
| 1349 | 4.51 | 3.95 | 58,330 | .160 |

XUM

Series I.

## TABLE NO. 9.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross sec. Ins. | Actual Area in Sq. in. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1350 | .5x.5 | .25 | 4,750 | 19,000 |
| 1351 | 1x1 | 1.03 | 14,470 | 14,050 |
| 1352 | 1.5x1.5 | 2.29 | 25,740 | 11,240 |
| 1353 | 2x2 | 4.06 | 42,880 | 10,560 |

Series I.

## TABLE NO. 10.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sb. In. Lbs. |
|---|---|---|---|---|
| 1354 | 1x1 | .25 | 4,900 | 19,600 |
| 1355 | 1.5x1.5 | 1.00 | 14,980 | 14,980 |
| 1356 | 2x2 | 2.25 | 23,160 | 10,290 |

Series I.

## TABLE NO. 11.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1357 | .5x.5 | .27 | 4,720 | 17,480 |
| 1358 | 1x1 | 1.02 | 15,100 | 14,810 |
| 1359 | 1.5x1.5 | 2.27 | 30,100 | 13,260 |
| 1360 | 2x2 | 4.04 | 45,440 | 11,250 |

Series I.

## TABLE NO. 12.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs |
|---|---|---|---|---|
| 1361 | 1x1 | .25 | 4,890 | 23,560 |
| 1362 | 1.5x1.5 | 1.00 | 14,700 | 14,700 |
| 1363 | 2x2 | 2.25 | 24,370 | 10,830 |

XUM

## TABLE NO. 13.

Series I.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1364 | .56 | .32 | 7,560 | 23,620 |
| 1365 | 1.13 | 1.14 | 24,210 | 21,850 |
| 1366 | 1.69 | 2.28 | 25,740 | 11,290 |
| 1367 | 2.15 | 4.06 | 39,660 | 9,780 |

## TABLE No. 14.

Series I.

Heavy Machinery Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1368 | 1.13 | .25 | 4,510 | 18,040 |
| 1369 | 1.69 | 1.00 | 14,120 | 14,120 |
| 1370 | 2.15 | 2.25 | 24,990 | 11,100 |

## TABLE NO. 15.

Series I.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1371 | .56 | .27 | 4,450 | 16,480 |
| 1372 | 1.13 | 1.03 | 14,470 | 14,050 |
| 1373 | 1.69 | 2.31 | 31,110 | 13,460 |
| 1374 | 2.15 | 4.08 | 44,600 | 10,930 |

## TABLE NO. 16.

Series I.

TENSILE TEST.

Heavy Machinery Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1375 | 1.13 | .25 | 4,200 | 16,800 |
| 1376 | 1.69 | 1.00 | 14,080 | 14,080 |
| 1377 | 2.15 | 2.25 | 23,110 | 10,270 |

XUM

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION, PITTSBURG, PA., JAN. 2, 1901.

*The Iron Trade Review*, Jan. 17th. The regular monthly meeting of the Pittsburg Foundrymen's Association, held Wednesday evening, Jan. 2, was not very well attended, many of the members being absent from the city owing to the holidays. For the first time in many months there was no paper for discussion, not because none was prepared, but on account of a slight delay caused by the express companies.

At the business session it was reported that the New England Society had replied to the letter sent to all the local associations notifying them of the recent action of the Pittsburg local whereby all the members joined the national body. The matter has not yet been considered by the New England association, but definite action will be taken at the next meeting, according to the reply.

The following letter was received from Mr. H. H. Hooker and read: "Through the generosity of Mr. Andrew Carnegie, Pittsburg is soon to have a technical institute, or trade school, which it can be safely assumed will be second to none. The mere fact that Mr. Carnegie is its founder is sufficient evidence of that, aside from the vastness of Pittsburg as an industrial center, in which such an institution will for all time command the greatest interest. In other technical institutions, trade schools, and the like, the improtant instruction in foundry practice and foundry methods is not given sufficient, if any attention. The members of the Pittsburg Foundrymen's Association will at once appreciate this, and it would seem to me that an opportunity now presents itself for our association to further this object. It is my suggestion that the trustees of the new institute be approached, either by resolution suitably engrossed or by personal visit of a committee with reference to giving such instruction a place in its curriculum."

XUM

Mr. Hooker's suggestion was well received and was followed by some discussion before action was taken. It was stated that while partial courses in foundry practice are given in some of the technical schools of the country none of them take the study up as fully as they should. A committee consisting of J. S. Seaman, F. H. Zimmers and D. P. Thomas was appointed to confer with the trustees of the institute and report at the next meeting.

---

*The Iron Trade Review*, Feb. 14th. The regular monthly meeting of the Pittsburg Founrymen's Association, held at Pittsburg, Wednesday evening, Feb. 6, was well attended. Owing to the large amount of routine business on hand, little time was given to the reading and discussion of papers, although it was the prevailing opinion, after the reading of Capt. Henning's paper on "Foundry Irons," as given last week, that some method should be devised for the standardization of foundry irons with a view to showing what qualities they have after being cast.

During the business session a letter was read from Paul Kreuzpointner, of Altoona, Pa., in which he heartily endorsed the action of the association in affiliating itself as a body with the American Foundrymen's Association.

A letter from Prof. L. E. Reber, Dean of the School of Engineering of the Pennsylvania State College, was also read. It was in answer to a memorial from the Pittsburg Foundrymen's Association regarding the education of young men in the principles and practice of founding. We make the following extract from Mr. Reber's letter: "As this is a state institution, it would seem especially fitting not only that should such a course be offered here but also that facilities be provided for carrying on experiments on a subject of such vital importance to the manufacturing interests of our commonwealth—a subject, too, from which there is so much that can be learned only by careful, systematic and extended experiment. In view of these facts we make the following suggestion: That the Foundrymen of Pennsylvania, those interested in this subject commercially, send a committee here to look over our equipment (we have a small foundry equipped for educational work) and facilities for doing work of this kind and that if after going over the ground it seems desirable, provisions be made for a series of experiments under

XUM

the general supervision of an advisory committee from the foundrymen of the state, and also for a course of instruction in foundry work in accordance with suggestions presented in your memorial.

"As the Pittsburg Foundrymen's Association has taken the initiative in this matter, as shown by the memorial presented to the American Foundrymen's Association, would it not be willing to send a committee here for the purpose indicated above? I think that you will agree that investigations carried on in this way should secure results that would eventually settle many problems now undetermined."

In accordance with the request made in this letter a committee consisting of William Yagel, T. D. West and F. H. Zimmers was appointed for the purpose of visiting the school and making the investigation requested. The committee will report at the next monthly meeting. After adjournment lunch was served.

---

## PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION, PHILADELPHIA, PA., JAN. 2, 1901.

*The Iron Age*, Jan. 10th. The one hundred and fourth regular meeting of the Foundrymen's Association was held at the Manufacturers' Club, on Wednesday evening, Jan. 2, 1901, Vice-President Jos. S. Stirling in the chair. There was a very fair attendance. Reading of minutes was dispensed with. L. & R. Wister & Co., 672 Bullitt Building, manufacturers and dealers in pig iron, steel scrap and coke, were elected to membership in the association. The executive committee communicated to the association, through the secretary, the fact of an amendment to their by-laws, lately adopted by the Pittsburg Foundrymen's Association, by which the dues were sufficiently increased to cover the yearly dues of the American Foundrymen's Association, thereby making a member of the Pittsburg Association also a member of the American Association.

After discussion it was resolved, on motion of Mr. Pesano, "That the secretary be instructed to inform all the members of the action of the Pittsburg Foundrymen's Association, and obtain a letter ballot on the subject and present same for special action at the next meeting of the association."

XUM

No other business being before the meeting, Mr. W. P. Pressinger, of the N. Y. Air Compressor Co., was introduced, who read a paper on "Pneumatic Tools and Appliances in Foundry Service." The paper was illustrated by means of a number of lantern slides. A number of views of automobiles, autotrucks and other appliances using compressed air as power were also shown. Considerable discussion followed the reading of the paper, and after a vote of thanks to Mr. Pressinger, adjournment followed to the roof garden, where luncheon was served and speeches made.

---

*The Iron Trade Review*, Feb. 14th. The regular monthly meeting of the Foundrymen's Association was held at the Manufacturers' Club in Philadelphia, on Wednesday, February 6th, the President, Thos. I. Rankin, occupying the chair. The attendance was good.

The secretary read a communication from John Davies, of John Davies & Sons, Brooklyn, N. Y., announcing the formation of an association of foundrymen in New York, to be called the New York Foundrymen's Association, and requesting a copy of this association's constitution and by-laws.

A number of letters received from members of the association in regard to the proposition made by the Pittsburg Foundrymen's Association, that the Philadelphia organization adjust its dues so as to include the fee for a membership in the American Foundrymen's Association were presented and read. The opinions expressed in the letters were in a large majority unfavorable to the proposed change. Many members, it seemed, already belonged to the national organization, and the established dues, it was felt, were sufficiently low to induce any one interested to become a member in addition to membership in a local association. A discussion ensued, nearly all of the speakers being opposed to any change. The matter was settled by a motion made by Thos. Devlin that the association as a body would not enter the American Foundrymen's Association. This was carried unanimously.

Jas. S. Stirling read a paper by Capt. Henning, of the Imperial Artillery, Berlin, Germany, on "Foundry Iron," as printed last week. A short discussion followed the reading of the paper, but as the writer did not mention the kind of castings he was

XUM

making it seemed difficult to draw any conclusions. W. D. Shedd pointed out that in Germany a very poor ore was used, as compared with the ores from which American irons were made, the former running from 35 to 50 per cent. iron, while the latter ran to 60 per cent. and above.

After adjournment the members sat down to lunch in the club cafe.

---

## PROCEEDINGS OF THE NEW ENGLAND FOUNDRYMEN'S ASSOCIATION, BOSTON, MASS.

*The Iron Trade Review*, Jan. 31st. At the recent annual meeting of the New England Foundrymen's Association, held at Hotel Essex, Boston, the following officers were elected for the coming year: President, George B. Buckingham, Arcade Malleable Iron Co., Worcester, Mass.; vice-president, Henry A. Carpenter, A. Carpenter & Sons Foundry Co., Providence, R. I.; secretary, Fred F. Stockwell, Barbour-Stockwell Co., Cambridgeport, Mass.; treasurer, George H. Lincoln, Geo. H. Lincoln & Co., South Boston, Mass.; executive committee, E. B. Farnsworth, McLagon Foundry Co., New Haven, Conn.; Theodore Colvin, Colvin Foundry Co., Providence, R. I.; B. M. Shaw, Walker & Pratt Mfg. Co.; Watertown, Mass.; William Doherty, Doherty Brothers, Lowell, Mass.; E. E. Durant, G. F. Warner Mfg. Co., New Haven, Conn.

---

*The Iron Trade Review*, Feb. 14th. The notice of the meeting of the New England Foundrymen's Association, to be held this week at Boston, states that the following report of a committee appointed to consider how the work of the association could be broadened will be considered: "Your committee appointed at the last meeting, to look into the matter and suggest how the association could create more interest at its meetings, and increase its membership thereby, respectfully submits the following. We would advise: 1. That the by-laws be so amended that the association can take in as members, men connected with foundry interests, for instance, pig iron commission merchants and foundry supply men. 2. That the dues be raised from five dollars per annum, to fifteen or twenty dollars per annum. 3. That the executive committee hire talent to give lectures or dis-

XUM

courses at our meetings on matters pertaining to foundry interests. Your committee think that by adopting the above suggestions, that the membership of the association would be more than doubled in a very short time, and that the treasury would have a large surplus, thereby enabling the association to hire the best talent and keep up the interest of the entire membership. (Signed) Wm. H. Carpenter, Bartlett M. Shaw, Wm. C. Doherty."

The meeting was also expected to consider the proposal to join the American Foundrymen's Association in a body.

---

## DISCUSSION OF MR. W. P. PRESSINGER'S PAPER ON "PNEUMATIC TOOLS AND APPLIANCES IN FOUNDRY SERVICE.

*The Iron Trade Review,* Jan. 10th, has the following report of the discussion by the Philadelphia Association:

H. O. Evans, in the course of a few remarks covering his experience with compressed air, said: I have been connected with a number of foundries during the past few years, and I think the most useful part of the equipment has been that providing for the use of compressed air. Of plants in my charge there were none where I did not increase the capacity of the compressed air service. Its greatest charm is its perfect cleanliness. It provides for the cheapest hoisting apparatus that can be put in a foundry. Sometimes I have had as many as 20 or more pneumatic hoists in use on one installation. We found that compressed air hoists were well adapted for handling hot iron safely. I can quite agree with Mr. Pressinger when he says you cannot put too large a compressor into a plant nor have the piping too large. There are so many uses for compressed air besides the hoists. One thing sometimes lost sight of is its adaptability for cheaply whitewashing or painting the interiors of foundries and shops.

Secretary Evans: I would like to ask Mr. Pressinger how, in case he wanted to use pneumatic cranes and other equipment, he would arrange for the different pressures.

Mr. Pressinger: If you are going to use a very large volume of air for sand blasting it would be better to instal the lighter pressure. It can readily be shown that here would be a decided

XUM

saving in the cost of a general installation to have a separate pressure for this work. For riveting you must have about 100 lbs. pressure. Compressed air in plants suffers somewhat from the fact that there is frequently an insufficient supply, and when many tools are run the pressure runs down. If you are going to realize all the advantages of the tools you must have plenty of compressed air. Even if a plant does cost a little more it is better to make a full provision at the start.

Secretary Evans: Instead of putting in a small compressor, in the case of a sand blast requiring, say, about 20 lbs. pressure, why not put in a high pressure so that you have the capacity?

Mr. Pressinger: In using only one or two chipping tools and a hoist or two it would not pay to have two compressors. It would be better to have a compressor for 80 lbs. to 100 lbs. and reduce this pressure for the sand blast.

Secretary Evans: I know of a case where they run chipping tools, a sand blast, and an oil melting furnace and they use a reducing valve to reduce the pressure from 80 lbs. to 25 lbs. and it works very well.

Mr. Pressinger: Yes, it would work all right.

Secretary Evans: Would it work with enconomy?

Mr. Pressinger: Not if you have a large installation. It is hardly economy to compress to 80 lbs. when you only need 20 lbs.

Mr. Stirling: In your air hoists can you get the positive movement in the down or up stroke?

Mr. Pressinger: The hoist is supposed to do that, but we have yet to see the oil governed hoist that will do it absolutely.

H. O. Evans: I think I have a positive hoist. I have built a hoist and made it work all right. I get my pressure on top of the oil. When a positive action is desired the full pressure is thrown on and and the air valve controlled. I put this hoist in for the express purpose of handling iron. I used to pour five pots to the ladle. I poured as fast as a 36-in. cupola could melt the iron.

Mr. Ridgway: We have just furnished to Wm. Sellers & Co. a direct acting air hoist, 50 tons capacity, a type which they are putting in cranes which they are furnising to a prominent iron company. The fact that a concern like this would take hold of an air hoist to the capacity of 50 tons for handling great ingots of steel under a hammer where large numbers of men would

XUM

be working would make you realize that it is possible to make an air hoist, governed by oil or water. We make large numbers of air hoists governed by oil, up to 5 and 10 tons' capacity all the time, and we have no trouble with them in thoroughly controlling their action. We are able now to supply any one with a perfectly controlled air hoist. There is a great demand, I think, for a first-class belt driven air compressor. We pipe our machines for both steam and air and in almost every foundry in which I have made installations I find they are going by steam entirely. In Fraser & Chalmer's new shop their equipment is composed of oil governed air hoists entirely.

Mr. Pressinger: I will say that the foundry trade has suffered a great deal through imperfect and insufficient air compressors, the installations being made on account of cheapness. I think, too, that foundrymen do not look after their compressors quite as well as other users. They should be kept clean and free from dust.

H. O. Evans: I have had perfect satisfaction with such compressors as I have used.

Mr. Stirling: We have compressed air which we use for various purposes, many outside of regular foundry work. We were probably among the first users of pneumatic rammers. We had one of the Cramp design, which is very good, but we found the vibration it caused was a little too much for our building. We have since used a portable kind which answers better.

Mr. Hallowell: In how small a foundry would it pay to install an air compressing plant? I should like an expression of opinion in regard to this. The size of the plant I think, must have a good deal to do with the real value of the installation.

Mr. Pressinger: There is hardly a foundry too small to use compressed air to advantage. If one or two chipping hammers can be used with a hoist or two, compressed air would prove profitable. The makers of apparatus stand ready to install equipments subject to fulfillment of claims they make as to what they will accomplish.

Secretary Evans: What would be the cost of the smallest equipment?

Mr. Pressinger: About $250 I think would cover the cost of a small equipment. In a foundry in Brooklyn the proprietor became interested of his own accord in compressed air, and came

XUM

to us to buy a compressor and appliances, and the foundry, I thought, was almost too small to recommend an outfit for. It was insisted on, however, and the installation was made and is to-day paying handsomely.

Secretary Evans: What does he use with it?

Mr. Pressinger: I think two chipping hammers and one or two hoists. He is well satisfied with his outlay.

Mr. Pessano: I can fully confirm what Mr. Pressinger said as to the advisability of any foundry requiring even two or three chipping tools and possibly an air drill or two putting in an equipment. We started ours with two chisels and a small compressor, and since then, inside of a little over a year, we have put in possibly 12 or 14 more chisels and 8 air hoists. We also do all our molding by compressed air, and the whole was the outcome of starting in a small way. I can also advise the installation of compressors of good size. I would like to ask Mr. Pressinger whether in his experience he has arrived at any established point as to the proper pressure for operating air chisel hoists, molding machines, and so on.

Mr. Pressinger: I should say 80 lbs. to 90 lbs., according to conditions. I would also point out the necessity for having absolutely air-tight piping. The loss from waste is not always understood and is greater than steam, and it is not always discovered. Much power is wasted through leakage.

---

*Engineering Magazine*, February, devotes considerable space in the editorial column to a review of Mr. Pressinger's paper, and states that the assumption on the part of the industrial world that the foundry is the least modern portion of the manufacturing layout is no longer justified. The rapid introduction of traveling cranes, molding machines and pneumatic appliances has changed the old order of things pretty materially. The use of compressed air especially has aided in facilitating foundry work, and Mr. Pressinger has shown this very fully in his paper.

---

## DISCUSSION OF CAPT. HENNING'S PAPER ON FOUNDRY IRON.

In *Eisen-Zeitung*, No. 1 Capt. Henning gives some data intended to supplement his recent paper on foundry irons: "The

prime object of every foundry is to furnish as nearly perfect castings as possible, either hard or soft as required, as strong and naturally also as cheap as possible. This prime object as stated is the natural consequence of the intimate relation of the foundry with the machine shop. Any betterment in the foundry is certain to result in cheaper output as a manufactured article. It is only occasionally (in Europe) that a foundry is a specialty in itself. Where a foundry is an adjunct to a machine shop the difficulties encountered in obtaining good castings are usually very great, for seldom do we find adequate room and equipment. Where the foundry specializes, however, we can look for the best results, as everything can be made to fit properly and economically. Once a foundry manager has obtained a good practice in his works and everything works out harmoniously and well, a sudden change in method is apt to have serious results. Similarly a change in the material, if unknown, may work havoc and the blame be laid up to the manager. A prominent German foundry made an extended series of investigations on the irons furnished by one blast furnace. The guaranteed analysis was to be total carbon 4.0-4.2 per cent.; silicon, 3.0 to 3.5 per cent.; manganese, 1.0 to 1.05 per cent.; phosphorus, .06 to .075 per cent.; sulphur, .02 to .04 per cent., or about 9 per cent. impurities, which in itself is already a little too high. This was in 1898. Now the actual run as analyzed at the foundry showed the range as follows: Total carbon, 3.53 to 3.97 per cent.; silicon, 2.59 to 3.36 per cent.; manganese, 0.98 to 1.21 per cent.; phosphorus, .062 to .130 per cent.; sulphur, .014 to .055 per cent. The results from this run of iron came out pretty well. In 1899 the variation was total carbon, 3.70 to 3.91 per cent.; silicon, 3.19 to 4.08 per cent.; manganese, 1.01 to 1.34 per cent.; phosphorus, .038 to .09 per cent.; sulphur, .015 to .028 per cent. The results began to come out poorer and doubtless the trouble came from a change in ores and admixtures. In 1900 we had total carbon, 3.52 to 5.1 per cent.; silicon, 2.00 to 4.34 per cent.; manganese, .41 to 1.23 per cent.; phosphorus, .03 to 1.00, and sulphur, .011 to .08 per cent. Here we had such remarkable variations that only serious changes in the blast furnace could account for them, the cheap and bad admixtures used being an unknown quantity. This experience has often been gone through by foundrymen—an otherwise fair brand of iron gradually deteriorating in quality until

XUM

no longer fit for good work. Possibly my American friends may have experienced the same trouble."

---

## DISCUSSION OF MR. PIERCE'S PAPER ON FOUNDRY IRON.

*Manchester World*, Manchester, England, prints a letter from Mr. John Sands, of Falkirk, Scotland, in which he writes as follows:

"I, as a practical molder, and one who seeks to foster proficiency and modern methods in the art, must emphatically denounce the idea of wood flasks. Any molder hailing from North Britain, where flasking is to-day nearly perfect, would laugh at the idea of any molder reading a paper on foundry flasks, and especially advocating the use of wood.

"I will illustrate, in the first place, the box parts or flasks used in a light workshop, say at the Carron Iron Works, N. B., where about 4,500 or 5,000 boxes, drag, and top part will be in use every day, and comprising a great many different shapes, such as flat boxes from 6 by 6 by 6 inches up to 48 by 48 by 8 inches, also rain-water goods, furnace pans, etc. Imagine this firm using wood flasks! Why, they would require the contents of a forest and an army of joiners to keep up the plant. But this is very briefly how it is done: Say they require to make a set of new box parts 36 inches broad by 60 inches long by 9 inches deep—that is, including drag and top part. Perhaps they want twelve full boxes, and to be wrought by hand—which they all are—until they reach a very large size. The box is the same all but lifting provision for the crane, such as a swivel at each end, or two bowl handles on each side. The pattern for the above box is made by a patternmaker—the drag part and the top part.

"The strength required for all these boxes varies, but the one in question would be, for the outside $\frac{3}{8}$ by $\frac{1}{2}$ inches, the top part bars the same, and the drag bars $1\frac{1}{2}$ by 1 inch.

"Side snugs, having provision for pins, are cast on, as also are hooks and eyes to clamp the two together when closed, and the requisite number of lifting handles for turning the drag and parting and closing the top part, two at each end and one on each side at the center. These boxes as a rule require no fitting,

generally as they are cast from an original pattern, with all its accessories cast—guide pins, hooks and eyes, and handles—so that the affair is simple, speedy, perfect, and economical. These boxes will work for years, although the replacing of a part is next to no cost at all.

"The boxes are all got up under the same rule, and can be utilized to work the plate system, or to suit any kind of tank or kiln plates, etc. There is nothing more perfect than the equipment in flasks of a light molding shop, or less costly to maintain.

"The jobbing department in any class, from building to marine work, is equally as easily equipped with flasks, and the rarest thing one sees is the casting of a new box part in any good-going jobbing shop. Wallace Foundry, Dundee, is almost perfect for simple and secure flasks for heavy work. The following is included in their stock, and will be found superior to timber. Supposing we say columns from 3 to 6 inches diameter, and any length. These can all be faced at any time by using straight stretches of flasks, say 9 inches broad by 7 inches deep, metal 1 inch thick, with side projections 3 inches out at each end for bolting, as many lengths together as one requires also a few headpieces, all one size at the projection, but varying in breadth and height, in order to meet extra large flanges or heads. Then a few more lying about, say from 15 inches broad and 11 inches high, with heads to suit, and one is well in for columns and girders up to 12 inches broad and up to any length desired. One extra large top part included, and one can never be caught napping. Regarding square or rectangular box parts, a small space, and not a large expense, will equip all that is required. An outside frame and one or two close bars, and one can cast a flask that will last as long as the youth that made it. I have seen boxes, say 48 inches square, top and drag, for crane work, and one could pick up frames from 3 to 6 inches deep, which could all be put together, giving a box 48 inches any way.

"Then a few large top parts lying around is all that is required. Space forbids me saying any more just now, but I will take up the flasking affair with my comrade in order to free from contamination the faculties of our younger molder friends. Wood flasks are positively a humbug, and should not be encouraged."

*The Foundry* of Feb., 1901, in printing this letter, adds the following interesting matter:

XUM

While we believe that many jobs are made in wooden flasks which could much more economically be made in iron flasks, still it is our opinion that wooden flasks for certain classes of castings possess more virtues and are not half as much humbugs as Mr. Sands would have us believe.

It is a well-known fact that the foundries of Great Britain and those of the Continent use iron flasks almost exclusively. While we have no doubt of Mr. Sands' assertion that the method of making flasks in North Britain is nearly perfect, yet in order to arrive at the relative merit of iron and wooden flasks we would rather state the question in a different manner.

Does the molders of North Britain turn out more castings per man with iron flasks than the molders of the United States with wooden flasks? Is the cost of flasks and repairs of same per pound of castings greater in the United States than in Great Britain?

Taking up the first we have heard it expressed by foundry proprietors and managers from the old world that the molders on this side turned out more castings in the same length of time than any other workmen they knew. Take our stove foundries, where wooden flasks are used almost universally, and substitute iron flasks, and how many molders will put up the same day's work as they are doing now?

For light castings of this kind the wooden flask is superior to the iron one. It permits a molder to make more molds because it is easier to handle, and it lasts a very long time with reasonable care, as the castings are shaken out at once and there is consequently no chance of burning either flask or bottom board.

If Mr. Sands will visit some of our foundries he will find that they do not have a forest or an army of carpenters either, in order to keep in operation. On the other hand, while we admire the beauties of the iron flask, we have a suspicion that these are not made without cost, nor kept in repair for nothing.

It is a question whether iron flasks of any kind do not cost as much or more than wooden flasks. It takes time to change the bars of an iron flask just as well as a wooden one. Rusty bolts cannot be taken off with the fingers nor guides adjusted after the same fashion.

What determines the relative value of iron and wooden flasks

is not the length of life of either nor their original cost. It is the output which can be obtained from them that counts, and as far as light work is concerned, a molder will turn out more castings with a light wooden flask than he will with a heavy iron flask.

The tendency of the age is not to furnish workmen with clumsy tools because these will last forever, but to give them light and handy appliances with which they can turn out the greatest volume of product. Iron flasks have their places where they are superior to wooden ones, but the latter also have claim to recognition, a fact attested by their continued use. If the universal adoption of iron flasks would in the least increase the output of American foundries the change would have been made long ago.

---

## PROCEEDINGS OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

### Progress Report of the Committee on Standardizing the Testing of Cast Iron.

#### CAST J—CYLINDER IRON.

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardinzing the testing of cast iron, furnished 88 tests.

Cast J illustrates a class of castings which must be very dense, even grained, and have the highest wearing qualities; imperviousness to steam, air and ammonia being essential.

The bars were made by the secretary and were presented to the committee in the interest of the trade.

The analysis of the one inch, dry sand, square bar, is as follows:

| | |
|---|---|
| Total Carbon | 3.39 |
| Graphite | 2.99 |
| Silicon | 2.49 |
| Manganese | .47 |
| Phosphorus | .839 |
| Sulphur | .084 |

The iron was quite fluid and the chill about one-sixteenth inch deep. The mixture contained scrap steel and some high sulphur pig iron.

XUM

## TABLE No. 1.

Series J.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Str in Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1378 | 0.5x0.5 | .49 | .49 | 380 | .14 |
| 1379 | 1x1 | 1.01 | 1.00 | 2,400 | .14 |
| 1380 | 1.5x1.5 | 1.50 | 1.50 | 5,790 | .13 |
| 1381 | 2x2 | 2.04 | 2.03 | 15,300 | .14 |
| 1382 | 2.5x2.5 | 2.51 | 2.51 | 23,970 | .11 |
| 1383 | 3x3 | 3.00 | 2.99 | 41,610 | .10 |
| 1384 | 3.5x3.5 | 3.52 | 3.51 | 64,150 | .08 |
| 1385 | 4x4 | 4.04 | 4.03 | 74,170 | .08 |

## TABLE No. 2.

Series J.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1386 | 1x1 | 5x5 | 270 | .16 |
| 1387 | 1.5x1.5 | 1x1 | 2,220 | .13 |
| 1388 | 2x2 | 1.5x1.5 | 4,950 | .11 |
| 1389 | 2.5x2.5 | 2x2 | 15,670 | .09 |
| 1390 | 3x3 | 2.5x2.5 | 21,080 | .08 |
| 1391 | 3.5x3.5 | 3x3 | 38,640 | .06 |
| 1392 | 4x4 | 3.5x3.5 | 62,500 | .06 |

## TABLE No. 3.

Series J.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1393 | 0.5x0.5 | .49 | .50 | 305 | .18 |
| 1394 | 1x1 | 1.03 | 1.03 | 2,080 | .17 |
| 1395 | 1.5x1.5 | 1.50 | 1.52 | 6,070 | .15 |
| 1396 | 2x2 | 2.02 | 2.03 | 14,000 | .15 |
| 1397 | 2.5x2.5 | 2.51 | 2.51 | 23,700 | .14 |
| 1398 | 3x3 | 3.03 | 3.01 | 39,350 | .13 |
| 1399 | 3.5x3.5 | 3.52 | 3.51 | 64,190 | .11 |
| 1400 | 4x4 | 4.00 | 4.00 | 76,320 | .11 |

Series J.

## TABLE No. 4.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Dry Sand and Machined.

| Square ar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1401 | 1X1 | 5X5 | 270 | .17 |
| 1402 | 1.5X1.5 | 1X1 | 2,140 | .14 |
| 1403 | 2X2 | 1.5X1.5 | 4,990 | .13 |
| 1404 | 2.5X2.5 | 2X2 | 13,420 | .12 |
| 1405 | 3X3 | 2.5X2.5 | 21,600 | .12 |
| 1406 | 3.5X3.5 | 3X3 | 39,370 | .09 |
| 1407 | 4X4 | 3.5X3.5 | 62,050 | .08 |

Series J.

## TABLE No. 5.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1408 | 0.56 | .54 | .55 | 420 | .19 |
| 1409 | 1.13 | 1.14 | 1.16 | 2,550 | .18 |
| 1410 | 1.69 | 1.71 | 1.73 | 5,540 | .16 |
| 1411 | 2.15 | 2.15 | 2.16 | 14,340 | .12 |
| 1412 | 2.82 | 2.84 | 2.84 | 27,770 | .13 |
| 1413 | 3.38 | 3.39 | 3.37 | 50,660 | .11 |
| 1414 | 3.95 | 3.96 | 3.90 | 66,240 | .08 |
| 1415 | 4.51 | 4.51 | 4.51 | 78,970 | .07 |

Series J.

## TABLE No. 6.

TRANSVERSE TEST.

Cylinder Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1416 | 1.13 | 0.56 | 300 | .19 |
| 1417 | 1.69 | 1.13 | 2,410 | .16 |
| 1418 | 2.15 | 1.69 | 6,020 | .14 |
| 1419 | 2.82 | 2.15 | 12,880 | .11 |
| 1420 | 3.38 | 2.82 | 25,300 | .12 |
| 1421 | 3.95 | 3.38 | 42,420 | .07 |
| 1422 | 4.51 | 3.95 | 64,590 | .07 |

XUM

Series J.

## TABLE No. 7.

### TRANSVERSE TEST.

Cylinder Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1423 | 0.56 | .55 | .56 | 390 | .20 |
| 1424 | 1.13 | 1.14 | 1.14 | 2,570 | .18 |
| 1425 | 1.69 | 1.69 | 1.68 | 6,580 | .17 |
| 1426 | 2.15 | 2.16 | 2.18 | 13,500 | .14 |
| 1427 | 2.82 | 2.83 | 2.85 | 26,500 | .13 |
| 1428 | 3.38 | 3.35 | 3.39 | 50,010 | .11 |
| 1429 | 3.95 | 3.97 | 3.94 | 65,200 | .08 |
| 1430 | 4.51 | 4.51 | 4.50 | 77,440 | .06 |

Series J.

## TABLE No. 8.

### TRANSVERSE TEST.

Cylinder Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1431 | 1.13 | 0.56 | 270 | .18 |
| 1432 | 1.69 | 1.13 | 2,510 | .17 |
| 1433 | 2.15 | 1.69 | 6,040 | .15 |
| 1434 | 2.82 | 2.15 | 11,400 | .15 |
| 1435 | 3.08 | 2.82 | 25,180 | .10 |
| 1436 | 3.95 | 3.38 | 46,370 | .07 |
| 1437 | 4.51 | 3.95 | 64,000 | .08 |

Series J.

## TABLE No. 9.

### TENSILE TEST.

Cylinder Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1438 | .5x.5 | .26 | 4,830 | 18,580 |
| 1439 | 1x1 | 1.04 | 17,900 | 17,000 |
| 1440 | 1.5x1.5 | 2.29 | 34,470 | 15,050 |
| 1441 | 2x2 | 4.04 | 59,710 | 14,780 |

Series J.

## TABLE No. 10.

### TENSILE STRENGTH.

Cylinder Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1442 | 1x1 | .25 | 5,030 | 20,120 |
| 1443 | 1.5x1.5 | 1.00 | 18,010 | 18,010 |
| 1444 | 2x2 | 2.25 | 36,540 | 16,240 |

Series J.

## TABLE No. 11.

### TENSILE STRENGTH.

Cylinder Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1445 | .5x.5 | .24 | 4,650 | 19,360 |
| 1446 | 1x1 | 1.02 | 17,800 | 17,450 |
| 1447 | 1.5x1.5 | 2.26 | 32,300 | 14,300 |
| 1448 | 2x2 | 4.03 | 57,240 | 14,200 |

Series J.

## TABLE No. 12.

### TENSILE TEST.

Cylinder Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1449 | 1x1 | .25 | 5,190 | 20,760 |
| 1450 | 1.5x1.5 | 1.00 | 17,900 | 17,900 |
| 1451 | 2x2 | 2.25 | 35,790 | 15,900 |

Series J.

## TABLE No. 13.

### TENSILE TEST.

Cylinder Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1452 | .56 | .26 | 5,970 | 22,960 |
| 1453 | 1.13 | 1.02 | 18,580 | 18,210 |
| 1454 | 1.69 | 2.26 | 38,300 | 16,940 |
| 1455 | 2.15 | 4.03 | 62,440 | 15,490 |

Series J.

## TABLE No. 14.

### TENSILE TEST.

Cylinder Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1456 | 1.13 | .25 | 5,860 | 23,440 |
| 1457 | 1.69 | 1.00 | 20,070 | 20,070 |
| 1458 | 2.15 | 2.25 | 41,920 | 18,630 |

XUM

Series J.

**TABLE No. 15.**

TENSILE TEST.

Cylinder Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs |
|---|---|---|---|---|
| 1459 | .56 | .27 | 6,060 | 22,440 |
| 1460 | 1.13 | 1.00 | 17,610 | 17,610 |
| 1461 | 1.69 | 2.24 | 37,310 | 16,600 |
| 1462 | 2.15 | 4.02 | 60,180 | 14,970 |

Series J.

**TABLE No. 16.**

TENSILE TEST

Cylinder Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1463 | 1.13 | .25 | 5,730 | 22,920 |
| 1464 | 1.69 | 1.00 | 19,660 | 19,660 |
| 1465 | 2.15 | 2.25 | 37,890 | 16,840 |

## CAST K—NOVELTY IRON.

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardizing the testing of cast iron, furnished 48 tests.

Cast K illustrates a line of work which must be soft in very thin section. The iron shall be extremely fluid, so that many light pieces can be made on a gate. Locks, light hardware, novelty work, electrical supplies would come under this class.

The bars were made by the secretary and were presented to the committee in the interest of the trade.

The analysis of the one inch, dry sand, square bar, is as follows:

| | |
|---|---|
| Total Carbon | 2.88 % |
| Graphite | .03 % |
| Silicon | 4.19 % |
| Manganese | .67 % |
| Phosphorus | 1.236% |
| Sulphur | .080% |

The fluidity strip ran up full and the chill piece showed only a faint evidence of a chilling effect beyond the closing up of the grain. The mixture contained high silicon and phosphorus irons stove plate scrap and odds and ends of light junk scrap.

Series K.

## TABLE No. 1.

TRANSVERSE TEST.

Novelty Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1466 | .5x.5 | .49 | .50 | 180 | .13 |
| 1467 | 1x1 | 1.01 | 1.02 | 1,470 | .08 |
| 1468 | 1.5x1.5 | 1.50 | 1.51 | 4,840 | .08 |
| 1469 | 2x2 | 2.02 | 2.02 | 12,420 | .10 |
| 1470 | 2.5x2.5 | 2.51 | 2.53 | 22,680 | .07 |
| 1471 | 3x3 | 3.03 | 3.01 | 34,120 | .05 |
| 1472 | 3.5x3.5 | 3.52 | 3.50 | 51,450 | .05 |
| 1473 | 4x4 | 4.02 | 4.03 | 65,680 | .03 |

Series K.

## TABLE No. 2.

TRANSVERSE TEST.

Novelty Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1474 | .5x.5 | .51 | .51 | 270 | .15 |
| 1475 | 1x1 | 1.02 | 1.01 | 2,130 | .10 |
| 1476 | 1.5x1.5 | 1.52 | 1.52 | 5,130 | .10 |
| 1477 | 2x2 | 2.02 | 2.01 | 12,240 | .09 |
| 1478 | 2.5x2.5 | 2.53 | 2.50 | 18,220 | .09 |
| 1479 | 3x3 | 3.00 | 3.02 | 36,430 | .06 |
| 1480 | 3.5x3.5 | 3.56 | 3.52 | 54,620 | .07 |
| 1481 | 4x4 | 4.01 | 4.01 | 64,340 | .04 |

Series K.

## TABLE No. 3.

TRANSVERSE TEST.

Novelty Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth $d$ Ins. | Actual Size Width $d$ Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1482 | .56 | .57 | .57 | 200 | .14 |
| 1483 | 1.13 | 1.13 | 1.14 | 1,860 | .11 |
| 1484 | 1.69 | 1.70 | 1.68 | 6,000 | .10 |
| 1485 | 2.15 | 2.15 | 2.15 | 10,910 | .07 |
| 1486 | 2.82 | 2.84 | 2.87 | 21,030 | .06 |
| 1487 | 3.38 | 3.39 | 3.40 | 39,500 | .07 |
| 1488 | 3.95 | 3.96 | 3.95 | 54,660 | .04 |
| 1489 | 4.51 | 4.53 | 4.53 | 70,020 | .03 |

XUM

Series K.

## TABLE No. 4.

TRANSVERSE TEST.

Novelty Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1490 | .56 | .57 | .56 | 240 | .17 |
| 1491 | 1.13 | 1.14 | 1.15 | 2,080 | .13 |
| 1492 | 1.69 | 1.67 | 1.69 | 5,810 | .11 |
| 1493 | 2.15 | 2.16 | 2.17 | 11,450 | .10 |
| 1494 | 2.82 | 2.83 | 2.84 | 21,950 | .10 |
| 1495 | 3.38 | 3.39 | 3.40 | 41,570 | .07 |
| 1496 | 3.95 | 3.97 | 3.96 | 56,770 | .05 |
| 1497 | 4.51 | 4.53 | 4.54 | 73,500 | .04 |

Series K.

## TABLE No. 5.

TENSILE TEST.

Novelty Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq In. Lbs. |
|---|---|---|---|---|
| 1498 | .5x.5 | .24 | 4,590 | 19,120 |
| 1499 | 1x1 | 1.00 | 14,760 | 14,760 |
| 1500 | 1.5x1.5 | 2.23 | 25,900 | 11,610 |
| 1501 | 2x2 | 4.02 | 34,730 | 8,630 |

Series K.

## TABLE No. 6.

TENSILE TEST.

Novelty Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1502 | .5x.5 | .26 | 5,300 | 20,380 |
| 1503 | 1x1 | 1.00 | 14,850 | 14,850 |
| 1504 | 1.5x1.5 | 2.24 | 27,110 | 12,100 |
| 1505 | 2x2 | 3.98 | 38,200 | 9,600 |

Series K.

## TABLE No. 7.

TENSILE TEST.

Novelty Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1506 | .56 | .26 | 5,630 | 21,650 |
| 1507 | 1.13 | 1.03 | 17,860 | 17,340 |
| 1508 | 1.69 | 2.27 | 36,820 | 16,220 |
| 1509 | 2.15 | 4.03 | 51,180 | 12,700 |

XUM

Series K.

**TABLE No. 8.**

TENSILE TEST.

Novelty Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1510 | .56 | .28 | 6,850 | 24,470 |
| 1511 | 1.13 | .99 | 17,430 | 17,610 |
| 1512 | 1.69 | 2.26 | 33,990 | 15,040 |
| 1513 | 2.15 | 4.00 | 45,040 | 11,260 |

## CAST L—GUN IRON.

**Completing the Series of Tests on the Various Classes of Cast Iron.**

This set of bars cast vertically and at the same time, in accordance with the specifications of the American Foundrymen's Association Committee on standardizing the testing of cast iron furnished 88 tests.

Cast L illustrates a class of castings which must combine the greatest strength and toughness with uniformity of texture, densely granular structure, and in fact be the very best material that can be produced in the foundry. It is therefore always made in the furnace and contains large proportions of charcoal iron. Cannon and mortars were formerly the best representatives of this class; at the present time special dies and machinery parts from which much is required may be given as examples.

The bars were cast by the secretary and presented to the committee in the interest of the trade.

The analysis of the one inch, dry sand, square bar, is as follows:

| | |
|---|---|
| Total Carbon | 3.12 |
| Graphite | 2.62 |
| Silicon | 2.32 |
| Manganese | .43 |
| Phosphorus | .676 |
| Sulphur | .044 |

The iron was exceedingly hot, coming from the open-hearth steel furnace, the chill was about one-sixteenth inch thick. The mixture contained steel scrap, some charcoal iron and furnace iron scrap.

Series L.

## TABLE No. 1.

TRANSVERSE TEST.

Gun Iron.—Bars in Green Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1514 | .5x.5 | .49 | .50 | 450 | .21 |
| 1515 | 1x1 | 1.01 | 1.00 | 2,960 | .18 |
| 1516 | 1.5x1.5 | 1.51 | 1.52 | 9,490 | .13 |
| 1517 | 2x2 | 2.00 | 2.00 | 22,400 | .12 |
| 1518 | 2.5x2.5 | 2.50 | 2.51 | 39,910 | .10 |
| 1519 | 3x3 | 3.02 | 3.01 | 64,020 | .09 |
| 1520 | 3.5x3.5 | 3.56 | 3.54 | 102,720 | .08 |
| 1521 | 4x4 | 4.04 | 4.05 | * | ... |

Series L.

## TABLE No. 2.

TRANSVERSE TEST.

Gun Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1522 | 1x1 | 5x5 | 370 | .32 |
| 1523 | 1.5x1.5 | 1x1 | 2,640 | .27 |
| 1524 | 2x2 | 1.5x1.5 | 8,750 | .23 |
| 1525 | 2.5x2.5 | 2x2 | 20,660 | .20 |
| 1526 | 3x3 | 2.5x2.5 | 36,450 | .17 |
| 1527 | 3.5x3.5 | 3x3 | 64,180 | .14 |
| 1528 | 4x4 | 3.5x3.5 | 87,910 | .10 |

Series L.

## TABLE No. 3.

TRANSVERSE TEST.

Gun Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Size Depth Ins. | Actual Size Width Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1529 | .5x.5 | .51 | .51 | 400 | .18 |
| 1530 | 1x1 | 1.01 | 1.01 | 2,520 | .17 |
| 1531 | 1.5x1.5 | 1.52 | 1.50 | 9,000 | .14 |
| 1532 | 2x2 | 2.00 | 2.02 | 22,440 | .12 |
| 1533 | 2.5x2.5 | 2.50 | 2.52 | 40,160 | .11 |
| 1534 | 3x3 | 3.01 | 3.01 | 65,370 | .10 |
| 1535 | 3.5x3.5 | 3.54 | 3.52 | 101,080 | .09 |
| 1536 | 4x4 | 4.04 | 4.04 | * | ... |

*Beyond range of machine.

Series L.

**TABLE No. 4.**

TRANSVERSE TEST.

Gun Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1537 | 1X1 | 5X5 | 350 | .28 |
| 1538 | 1.5X1.5 | 1X1 | 2,200 | .21 |
| 1539 | 2X2 | 1.5X1.5 | 7,440 | .20 |
| 1540 | 2.5X2.5 | 2X2 | 18,600 | .16 |
| 1541 | 3X3 | 2.5X2.5 | 41,520 | .14 |
| 1542 | 3.5X3.5 | 3X3 | 60,280 | .10 |
| 1543 | 4X4 | 3.5X3.5 | 90,110 | .09 |

Series L.

**TABLE No. 5.**

TRANSVERSE TEST.

Gun Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1544 | .56 | .56 | .57 | 520 | .24 |
| 1545 | 1.13 | 1.14 | 1.14 | 3,470 | .17 |
| 1546 | 1.69 | 1.69 | 1.68 | 10,530 | .15 |
| 1547 | 2.15 | 2.17 | 2.19 | 22,550 | .14 |
| 1548 | 2.82 | 2.83 | 2.84 | 43,730 | .12 |
| 1549 | 3.38 | 3.39 | 3.40 | 75,460 | .11 |
| 1550 | 3.95 | 3.97 | 3.95 | * | ... |
| 1551 | 4.51 | 4.52 | 4.51 | * | ... |

Series L.

**TABLE No. 6.**

TRANSVERSE TEST.

Gun Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Appro. Orig. Diam. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection. Ins. |
|---|---|---|---|---|
| 1552 | 1.13 | .56 | 460 | .35 |
| 1553 | 1.69 | 1.13 | 3,260 | .31 |
| 1554 | 2.15 | 1.69 | 9,710 | .27 |
| 1555 | 2.82 | 2.15 | 20,480 | .20 |
| 1556 | 3.38 | 2.82 | 41,190 | .19 |
| 1557 | 3.95 | 3.38 | 70,770 | .14 |
| 1558 | 4.51 | 3.95 | 98,640 | .10 |

*Beyond range of machine.

Series L.

## TABLE No. 7.

TRANSVERSE TEST.

Gun Iron.—Bars in Dry Sand and not **Machined.**

| Round Bar No. | Approx. Diam. Ins. | Actual Size Depth *d* Ins. | Actual Size Width *d* Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|---|
| 1559 | .56 | .57 | .54 | 500 | .24 |
| 1560 | 1.13 | 1.16 | 1.16 | 3,440 | .20 |
| 1561 | 1.69 | 1.72 | 1.71 | 10,950 | .16 |
| 1562 | 2.15 | 2.14 | 2.11 | 21,100 | .14 |
| 1563 | 2.82 | 2.84 | 2.87 | 42,880 | .11 |
| 1564 | 3.38 | 3.38 | 3.39 | 75,360 | .11 |
| 1565 | 3.95 | 3.97 | 3.99 | * | ... |
| 1566 | 4.51 | 4.52 | 4.54 | * | ... |

Series L.

## TABLE No. 8.

TRANSVERSE TEST.

Gun Iron.—Bars in Dry Sand and **Machined.**

| Round Bar No. | Approx. Orig. Diam. Ins. | Actual Size as Machined Ins. | Breaking Strain Lbs. | Deflection Ins. |
|---|---|---|---|---|
| 1567 | 1.13 | .56 | 410 | .36 |
| 1568 | 1.69 | 1.13 | 3,360 | .34 |
| 1569 | 2.15 | 1.69 | 8,420 | .30 |
| 1570 | 2.82 | 2.15 | 22,070 | .24 |
| 1571 | 3.38 | 2.82 | 43,650 | .19 |
| 1572 | 3.95 | 3.38 | 70,110 | .14 |
| 1573 | 4.51 | 3.95 | 97,500 | .10 |

Series L.

## TABLE No. 9.

TENSILE TEST.

Gun Iron.—Bars in Green Sand and not **Machined.**

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1574 | .5x.5 | .23 | 7,430 | 32,300 |
| 1575 | 1x1 | .98 | 22,000 | 22,450 |
| 1576 | 1.5x1.5 | 2.24 | 42,820 | 19,110 |
| 1577 | 2x2 | 3.96 | 66,530 | 16,800 |

*Beyond range of machine.

Series L.

## TABLE No. 10.

TENSILE TEST.

Gun Iron.—Bars in Green Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1578 | 1x1 | .25 | 7,110 | 28,440 |
| 1579 | 1.5x1.5 | 1.00 | 25,670 | 25,670 |
| 1580 | 2x2 | 2.25 | 48,890 | 21,730 |

Series L.

## TABLE No. 11.

TENSILE TEST.

Gun Iron.—Bars in Dry Sand and not Machined.

| Square Bar No. | Approx. Cross Sec. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1581 | .5x.5 | .26 | 8,340 | 32,080 |
| 1582 | 1x1 | 1.01 | 25,130 | 24,880 |
| 1583 | 1.5x1.5 | 2.27 | 52,350 | 23,060 |
| 1584 | 2x2 | 4.02 | 68,180 | 16,960 |

Series L.

## TABLE No. 12.

TENSILE TEST.

Gun Iron.—Bars in Dry Sand and Machined.

| Square Bar No. | Approx. Orig. Cross Sec. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1585 | 1x1 | .25 | 7,640 | 30,560 |
| 1586 | 1.5x1.5 | 1.00 | 26,880 | 26,880 |
| 1587 | 2x2 | 2.25 | 44,470 | 19,760 |

Series L.

## TABLE No. 13.

TENSILE TEST.

Gun Iron.—Bars in Green Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1588 | .56 | .26 | 8,740 | 33,610 |
| 1589 | 1.13 | 1.03 | 30,460 | 29,570 |
| 1590 | 1.69 | 2.27 | 51,490 | 22,680 |
| 1591 | 2.15 | 4.02 | 69,950 | 17,400 |

XUM

Series L.

## TABLE No. 14.

TENSILE TEST.

Gun Iron.—Bars in Green Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1592 | 1.13 | .25 | 8,220 | 32,880 |
| 1593 | 1.69 | 1.00 | 31,330 | 31,330 |
| 1594 | 2.15 | 2.25 | 47,000 | 20,890 |

Series L.

## TABLE No. 15.

TENSILE TEST.

Gun Iron.—Bars in Dry Sand and not Machined.

| Round Bar No. | Approx. Diam. Ins. | Actual Area in Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1595 | .56 | .28 | 9,130 | 32,610 |
| 1596 | 1.13 | 1.04 | 33,680 | 32,380 |
| 1597 | 1.69 | 2.31 | 65,270 | 28,250 |
| 1598 | 2.15 | 4.03 | 72,010 | 17,870 |

Series L.

## TABLE No. 16.

TENSILE TEST.

Gun Iron.—Bars in Dry Sand and Machined.

| Round Bar No. | Approx. Orig. Diam. Ins. | Area as Machined Sq. In. | Breaking Strain Lbs. | Ult. Strength per Sq. In. Lbs. |
|---|---|---|---|---|
| 1599 | 1.13 | .25 | 7,940 | 31,760 |
| 1600 | 1.69 | 1.00 | 30,540 | 30,540 |
| 1601 | 2.15 | 2.25 | 52,880 | 23,500 |

XUM

## DISCUSSION ON MR. THOMAS D. WEST'S PAPER ON THE GRADING OF PIG IRON ANALYSIS.

*The Iron Trade Review*, March 14th, 1901. The paper was discussed at some length and many valuable points were brought out. It was pretty generally conceded that the failure of furnacemen to secure high percentages of silicon is due to the manner of pushing the furnaces to-day to secure the greatest possible output. It was stated that in order to secure iron containing more than 2 per cent. silicon a furnace cannot be worked as fast as is customary to obtain the best tonnage, and that more fuel is required, making the iron more costly. An example was cited of a furnace producing 300 tons of foundry iron daily, averaging about 1.50 per cent. silicon. In order to raise the silicon one per cent. the producing capacity of the furnace would probably be reduced 50 tons daily, and the cost of the fuel would be much greater than when the furnace was producing 300 tons of 1.50 silicon iron. Thus it was shown that the furnacemen are not at all anxious to produce high silicon iron when the difference in the cost is so great, especially when the falling off in the production of iron is taken into consideration.

It was stated by one of the foundrymen present that it was much easier to secure soft irons 10 or 15 years ago than at the present time. This was explained to be due to the fact that the furnacemen at that time did not drive their furnaces as they do to-day. It was explained also why some furnacement call their iron, containing only 0.50 per cent. silicon, a No. 1 iron, while others put their iron running over even 4 per cent. of silicon in the same class. It was suggested that other elements beside silicon and

sulphur should be considered in the proper grading of foundry iron. Some thought that carbon should be largely considered as a factor. Since it has been proved by experiment that the higher the silicon the lower the carbon, and the lower the carbon the higher the silicon, carbon might be used in the grading of pig iron the same as sulphur. One of the foundrymen asked whether it was not a fact that the higher the carbon in the iron the softer it would be. Mr. West explained that while this was generally supposed to be the case, it had not been proved absolutely to be a fact. In buying irons, however, it was stated that it is thought better to purchase that containing a high percentage of carbon and a correspondingly low percentage of silicon than a low percentage of carbon and a high percentage of silicon. In answer to another question Mr. West explained that in the total amount of carbon contained in one iron it made no difference whether it was low in combined carbon and high in graphitic, or high in combined and low in graphitic.

To secure the proper grading of pig iron it was explained that the assistance of the foundrymen should be secured as well as that of the furnacemen, inasmuch as many foundrymen still insist on buying their iron by fracture. A little incident explaining this point was related of a foundryman who sent an order to a furnace for a No. 1 iron with an open grain. He was given a No. 1 iron with an open grain, but an analysis of the iron showed that it contained only 0.75 per cent. of silicon. It was stated that without a doubt this foundryman was sure he had a soft iron when he saw its grain and the resulting hard casting would be first blamed on the coke, the cupola, the melter or the remaining hundred and one excuses given for hard castings, apart from the iron.

However, the furnaceman runs the risk of being finally held responsible and of loosing trade on the supposition that he is using new ores or doing something to make "bad iron."

XUM

*Journal of the American Foundrymen's Association.*

VOL. IX. JUNE, 1901. PART II.

## PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

The following open letter written to Mr. F. H. Zimmers, Secretary of the Pittsburg Foundrymen's Asociation, by the only honorary member of that association, is so much to the point that it is given in full herewith. It relates to the joining of the Pittsburg Association in a body with the American Foundrymen's Association, proposed at that time and since carried out. Mr. P. Kreuzpointner, of Altoona, Pa., is the author. He writes:—

"I thank you very much for the courtesy of remembering me and would like to say to the foundrymen of Pittsburg to vote for the proposed change and thus becoming members of the American Foundrymen's Association in a body. The question whether this is advisable has two sides; the purely mercenary one is how much pecuniary benefit can a member of the Pittsburg Foundrymen's Association get out of it during the year for his six dollars, and how much more will he derive in proportion to the increased membership fee (ten dollars). Assuming now such benefits are sufficiently tangible and approximately calculable. This is the dollar and cents standpoint and business side of the question. The other side is more of an ethical nature because it appeals partly to the moral standpoint of the members by asking them to make some sacrifices for the common good. The immediate benefits of a widened sphere of membership activity, with increased cost, becomes necessarily more conjectural than what we can perceive in a narrow circle, and therefore we appear to make sacrifices for someone's benefit when we expect to reap benefits ourselves. Are we justified to make such sacrifices?

I take the liberty to say that the view of looking upon this question only from the point of immediate calculable gain within the narrow circle of the local association would be a very nar-

XUM

row one, narrow because the industrial conditions of our country have changed so radically during the last few years that the individual industries can only flourish either by one absorbing all those around him, thus acquiring the ability to attract to himself all those advantages of skill, knowledge and information which are obtainable through the power of large capital, and to obtain which the small proprietor lacks the means; or for the smaller concerns to unite into one association, to throw their interests into one common pot as it were, and by the co-operation of numbers acquire for each individual member those advantages of increased skill, knowledge and information which are necessary now-a-days to be able to survey successfully the ever increasing field of industrial and commercial activity notwithstanding the skill, knowledge or information may not be immediately applicable for turning it into dollars and cents.

"In an intelligent discussion of a proposition like the one presented to the Pittsburg Foundrymen's Association the undeniable fact must be taken into consideration that the forces and circumstances which tend and contribute to the success of a modern industrial enterprise are no longer confined to one locality, or more or less circumscribed district, but the telegraph, telephone, cheap transportation, new scientific discoveries, the restless energy of inventors to produce new mechanical contrivances and the increased and every increasing exchange and interchange of ideas and experiences between nations and individuals, as well as scientific, technical and engineering societies, and last, but not least, the ease and security with which commercial transactions are carried on, all these have contributed to force the businessman, the manufacturer, to look beyond his immediate locality for his customers; it has forced him to defend his interests not only against competition in his neighborhood, but also that which may be far away; moreover technical knowledge has become and is becoming more and more a potent factor of success in any industrial venture, and since this knowledge has become world-wide and in turn is contributed to an enlarged from all over the world, the businessman and manufacturer has to range over a wide field nowadays to gather up the details which, when selected and put together with care and good judgment, will enable him to be successful and have his hopes and wishes realized.

XUM

"Technical knowledge is entering so largely now into all human transactions, private, municipal and national, that one can not be called a good citizen nowadays who neglects to acquaint himself with that knowledge which, if judiciously applied, determines the successful economic management of a municipality and the state, hence enters into and determines the weal and woe of a community from a material standpoint. But the principal which applies to the larger affairs of a municipality or a state, applies with equal effect to the smaller circle of an association and the individual. An instance of the extent of application of technical knowledge I find in my own work. To-day, I, as a subordinate, must have certain technical knowledge at my finger's ends for instant use and application which was not asked for from my superiors twenty or fifteen years ago, simple because at that time things were entirely unknown which, not to know now, a technical man would be ashamed of. If, during the necessary process of gathering together this increased knowledge for our use, we have to go further afield and wear off more shoe-leather and use more spending money, apparently for some other "fellers" benefit, then this is a consequence of modern industrial, commercial and social conditions. The necessity of co-operating with the other "feller" for our own sake is a healthy and desirable counterbalance to exercise individuality and egotism. It is a reminder that we are gregarious creatures and cannot live alone and all for ourselves. Eventually all such apparent sacrifices come back again as benefits in one way or another, if not directly, then indirectly.

"How this is realized by shrewd business communities is shown by German cities sending out bright, young, ambitious, technical men, to the United States, to South America, to China, i. e., to see what they can see and learn what they can learn, and then come back and give the industries of their city the benefit of what they learnt. The city pays the way of these young men. Can they repay it eventually, all right, if not then not. A narrow view would object to give these young men the benefit of travel at the expense of the municipality. The broader view recognizes the necessity of roaming over a large field to see what others do and since all cannot go one is sent for the advantage of all.

"These are the reasons why I am in favor of voting for the proposition of the Pittsburg Foundrymen joining the American Association at an increased individual expense.

"Yours very truly,

"P. Kreuzpointner."

---

MARCH 14th, 1901.

*The Iron Trade Review*, March 14: As a result of the discussion of Thomas D. West's paper on "Erratic and Systematic grading of Pig Iron by Analysis," which followed the reading of this paper by its author, at the regular monthly meeting of the Pittsburg Foundrymen's Association, held at the rooms of the Builders' Exchange, at Pittsburg, on Wednesday evening, March 6, a committee consisting of Mr. West and Dr. Richard Moldenke was appointed for the purpose of making further investigations along the lines sugested by Mr. West and to report the results of such investigation at the convention of the American Foundrymen's Association to be held in Buffalo in June. The committee will bring the matter before the convention in such a way that it will be possible to take definite action looking towards the systematic grading of pig iron. The movement looks toward the entire abolishment of the present practice of grading iron as the furnacemen or foundrymen sees fit.

After the termination of the discussion action was taken on the death of the late Capt. Altsman, who was a member of the Pittsburg Association from its inception. Words of praise were spoken of the worth of the deceased and a committee consisting of Secretary F. H. Zimmers, William Yagel, and S. T. Sleeth was appointed to draw up resolutions and present them to the family of the deceased.

*The Iron Trade Review*, March 9: A communication received from Local Union No. 46, of the Iron Molders' Union of North America located at Pittsburg, precipitated an interesting discussion at the regular monthly meeting of the Pittsburg Foundrymen's Association, held in the rooms of the Builders' Exchange, Pittsburg, Wednesday evening, May 1. The communication stated that the molders wished to discuss the apprenticeship question with a committee representing the Pittsburg Foundrymen's Association, but the letter failed to state

XUM

the phase of the question to be discussed. The presumption was that the molders would endeavor to enforce the 8 to 1 rule, that is one apprentice to every eight molders and where less than eight molders are employed only one apprentice to a shop. This rule is no doubt being violated in Pittsburg foundries, as well as in foundries throughout the country, in view of the inadequate supply of skilled molders. In the Pittsburg district nearly every foundry is working short handed and the local union is unable to supply molders when asked to do so. Despite this condition of affairs it is apparent that the union wants to stir up this question at the present time, whereas the rigid enforcement of the rule would make the foundries more short handed than ever.

The advisability of the association taking up this matter was the first question raised. Some were of the opinion that it came within the scope of the constitution and that the association had power to treat with the molders if it sought to do so. Others believed that it was a question to be taken up and adjusted by the National Founders' Association and a resolution was adopted suggesting that the local union refer the matter to its national officers for consideration with the National Founders' Association.

It was stated by foundrymen during the discussion of this question that the enforcement of the 8 to 1 rule would mean in time a marked depletion of the craft. The constantly growing demand for molders throughout the country, it was, argued, necessitates increase in the number of apprentices and possibly requires a shortening of the term of service. Computed on the 1 to 8 scale, with four years of apprenticeship, the average working life of a molder should be 32 years to maintain the supply, and this the foundrymen at the meeting believed to be far from the truth. While no figures regarding this interesting phase of the question were at hand some of the foundrymen expressed the opinion that 15 years would be much nearer the average usefulness of a molder at his trade than 32.

The reading of the paper prepared for the evening was dispensed with and the coming convention at Buffalo was discussed. From expressions by those present it is evident that Pittsburg will again be well represented at the convention. It is probable that a Pullman car will be chartered by the asso-

XUM

ciation. Secretary Zimmers will notify the members within a few weeks just what arrangements he has made, after learning how many contemplate attendance at the convention. The next meeting of the Pittsburg Association will be held on June 12 as the Buffalo convention interferes with the regular meeting night.

---

## PROCEEDINGS OF THE NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

MARCH 13th, 1901.

*The Iron Trade Review*, March 21: The monthly meeting of the New England Foundrymen's Association was held at Boston, Mass., on Wednesday, March 13. At the session in the afternoon an address on "Cupola Construction and Management" was presented by Thos. D. West, accompanied by a number of charts, which were commented upon by the speaker. A synopsis of the address is given elsewhere. This session was very interesting and profitable, lasting until 5:30. Then followed an informal half hour and at 6 o'clock dinner was served, covers being laid for 49 persons, all but two of whom were foundrymen. The evening session for the discussion of foundry topics began at about 8:30 and lasted until 10:30. It was chiefly an informal quiz, Mr. West being kept on his feet most of the time answering questions, which in turn provoked lively discussion. Mr. West made some comments at the outset on latter-day methods of mixing iron. He referred to the practice of choosing iron by fracture as having been handed down from those who first made use of appliances to remelt cast iron. This was done first in crucibles and later in calabashes, which are similar to cupolas but movable. They were used as far back as 1734. Mr. West stated that over half of the founders of the country are now working by analysis in making mixtures and these could by no means be persuaded to return to the old method. It is true that some have tried to work by analyses and failed. This is not the fault of the science of chemistry. Simply accepting a furnace analysis of pig iron and trying to be guided by it will not make a founder successful in the use of chemical analyses. There are many things to be considered and carefully guarded against, in order to make this practice a success.

XUM

No founder who worked by facture could show such records for regularity in results as were attained by those using analysis. The speaker combated the idea that the hardness of pig iron could be a guide to the character of the castings it would produce. He urged the foundrymen present to do all in their power to advance the practice of employing chemistry for the making of mixtures.

The meeting was presided over by President George B. Buckingham, Fred F. Stockwell, secretary. A vote of thanks was given Mr. West for his paper and for his willing response to all the questions asked by his auditors.

---

## PROCEEDINGS OF THE FOUNDRYMEN'S ASSOCIATION OF PHILADELPHIA, PA.

MARCH 6th, 1901.

*The Iron Age*, March 14, 1901: The one hundred and sixth regular meeting of the Foundrymen's Association was held at the Manufacturers' Club, Philadelphia, Pa., Wednesday evening, March 6, the president, Thomas I. Rankin, occupying the chair. In the absence of the secretary the chair appointed James S. Stirling to act as secretary pro tem.

There was a large and representative attendance. The minutes of the previous meeting were dispensed with in the usual manner. No business of importance was before the association and the presentation and reading of papers was proceeded with. A paper on "The Erratic and Systematic Grading of Pig Iron by Analysis," by Thomas D. West, of Sharpsville, was presented and copies distributed to those present.

Antonio C. Pessano, vice president of the National Foundrymen's Association, was then introduced and presented a paper on "The Organization of Manufacturers a Necessity, if the Best Results are to be Obtained from Organized Labor." Mr. Pessano prefaced his paper with a few remarks, in which he said "that the greatest point brought out by the Cleveland strike was the benefit of organization for the protection of manufacturers. These organizations, if on a proper basis, would be the means of avoiding strikes, lockouts, etc., and the better enable reasonable adjustment of differences between employer and employees."

XUM

Considerable discussion followed the reading of the paper. Messrs. Sellers, Pfahler, Williams, Rankin and others taking part, and the various parts and points of the recent agreement between the National Foundrymen's Association and the Iron Moulders' Union of North America were explained by Mr. Pessano, after which it was moved and seconded that a suitable number of copies of Mr. Pessano's paper be printed at the expense of the association and distributed to the men in the various foundries. This motion by amendment was referred to the executive committee with power to act. The motion was favorably acted upon and a vote of thanks was then tendered Thomas D. West and Antonio C. Pessano for their interesting papers, after which the meeting adjourned.

The members and their friends then proceeded to the roof garden of the club, where the usual luncheon was served, Thomas I. Rankin performing the duties of toastmaster in his usual pleasant manner, calling in turn upon Walter Wood, Alfred Rex, G. E. Pickup, J. R. Newkirk, J. W. Finley, each of whom responded with a short address, after which the social session of the association came to a close.

*The Iron Age*, April 11. In the absense of the president, Mr. Joseph S. Sterling, the vice president, occupied the chair. Owing to the extremely inclement weather the attendance was small. The treasurer reported a balance on hand amounting to $1,900 and all indebtedness paid. The executive committee reported that a number of extra copies of Mr. Pessano's recent paper were printed and ready for distribution. Inquiries should be addressed to Secretary Howard Evans. Mr. Randall's paper was then presented and distributed. After a general discussion upon topics of interest the meeting adjourned.

XUM

JOURNAL OF THE

# American Foundrymen's Association.

# REVIEWS.

VOL. IX. PART III.

XUM

XUM

## THE STEEL CASTING INDUSTRY OF TO-DAY.

*The Iron Trade Review*, July 14: M. A. Tissot read a paper before the Mining and Metallurgical Congress at Paris last month which speaks of the steel casting industry from the French standpoint.

Steel castings were made 50 years ago. The difficulty of obtaining large bodies of hot steel were such that only recently could steel castings be made on any large scale. The use of the Bessemer process by M. Robert in 1885 in his side blast converter was, according to Mr. Tissot, the starting point of the new industry.

The melting point of steel varying from 2,640 to 2,730 degrees F., is a very high one, and as the shrinkage amounts to about one-fifth inch to one-quarter inch per foot, according to the composition and temperature, any undue resistance of the mold to cooling strains means cracks and warping. Then comes still the question of blowholes.

Things are much better now, however, and only the addition of ribs to parts liable to strain and the early removal of cores was needed to overcome the chief difficulty in the work. A Refractory sand of quartz, silica brick and clay well mixed has given excellent results for molds, and modern appliances such as cranes, hoists, compressors, etc., together with good open hearth furnaces, furnish the best means to get uniform metal properly handled. Electrical welding is now used to remedy slight defects, and the molding machine is also extensively used for wholesale production.

A new trick of so-called air tempering is given by Mr. Tissot. The castings are heated up to 1,830 degrees F., then suddenly exposed to air at 1,830 degrees down to 1,100 degrees F. This is said to vastly increase the power to resist shock and increase the elasticity and toughness. It may interest our American malleable men to hear that improvements in the crucible furnace have resulted in the production of very delicate and malleable castings with a metal of lower carbon than heretofore. Acid and basic steel is now much better than it was and the use of aluminum, nickel, etc., is now very prevalent. The average composition of open hearth foundry steel in France is as follows:

XUM

Carbon ..... ..... ..... .25 to .50 per cent.
Manganese ..... .....1.00 to .50 per cent.
Silicon ..... ..... ..... .20 to .45 per cent.

Furnaces of 50 tons are now run successfully for steel castings, and the Robert converter takes up to 13,000 lbs for a charge. Special chrome and manganese steels are readily made now. The proper point at which a steel should be tempered is that at which it is in a feebly magnetic condition at a high temperature, hence the determination of the point of magnetic transformation should be sufficient to fix the temperature suitable for tempering. A chrom-tungsten steel; tempered, that is, a self hardening steel so-called, makes the best tools for machining.

## FOUNDRY CONVEYORS.

*The Iron Trade Review*, June 14. Dr. R. Moldenke gives a summary of the various uses conveyors are and may be put to in the foundry. Beginning with the raw materials used, the question of storing coke upon the cupola platform is taken up and the natural solution suggested. Similarly molding sand can be stored in overhead bins if desired, where floor space is valuable or not to be had. The plain bucket conveyor lifting the sand from the bottom of pits, into which the sand has been emptied, to any height desired, makes a very cheap and efficient arrangement.

Pig iron is more difficult to handle. A system of buggies loaded from the proper pile and transferred to the charging platform, either by a rope drive combined with an endless plane, or an electric traction method in connection with the regular hoists, would give equally satisfactory results. Pig iron handling methods using power extensively would probably only pay in large foundries, the smaller ones doing well enough by equipping themselves with metal buggies, narrow gauge track and turntables. Where the hearth furnace is used the metal yard is usually situated so that a traveling crane can bring the charge directly upon the platform.

After the iron is tapped it must be taken to the molds. With heavy work this is best done with the now very perfect traveling and power jib cranes. For light work, however, where smaller quantities must be handled at a time and in rapid succession, this method will not do. Buggy ladles of some thousands of pounds

XUM

capacity may be run on a narrow gauge track directly under the cupola spout and from there take the metal to the larger molds or empty into the usual shanks for hand pouring. The better method, however, is to suspend ladles from above and run them on an endless track system passing the cupola spout and pouring directly into the molds arranged in proper position.

Carrying the molds themselves into close proximity to the melted iron is the system now being used in half a dozen well known foundries, and some modification of this method suited to the particular needs of the shop seems to be the conveying system most carefully looked into at the present time. Molds may be either carried on the ground and iron overhead, or they may be suspended from overhead tracks by means of air hoists and the iron poured as may be most convenient.

Next comes the sand tempering and distributing system, which is always more or less elaborate, the reciprocating conveyor being found best for this purpose, as it practically shovels over the previously wetted sand so often that it is perfectly tempered and ready for the molder.

Next comes the rather neglected field of conveyors for castings in the cleaning and finishing departments. These will depend entirely upon the class of work and the quantity to be handled, but should be exceedingly profitable to install.

Finally coal conveyors for boiler and producer gas purposes are discussed briefly. The whole subject is one of the greatest importance in designing new plants or improving old ones, and merits our serious consideration.

## FRACTURE IN PIG IRON.

*American Manufacturer*, June 21. Dr. Edward Kirk gives a number of hints to users of pig iron intended to aid them in melting it intelligently. It is stated that without a practical knowledge of fracture indications a chemist can never be a practical analyst of foundry irons, for he would have his mixtures spoiled by accidental introduction of the wrong irons which he could not distinguish unless thoroughly posted on fractures. In a sense this is true; on the other hand the errors he might commit in rejecting irons as unsafe or mixed are just as numerous if judged by fracture as a check upon analysis.

XUM

Dr. Kirk goes on to state that when analyzing borings the fracture of the piece shall also be studied so that the eye can be trained to eventually predict from the fracture the supposed contents of silicon, sulphur, phosphorus, etc. In this way the actual chemical work can be reduced to a minimum and more attention given to the cupola practice. This looks very well on the face of it, but as pig irons are made to-day such a study would soon confuse the mind of the beginner, and only after a man is thoroughly posted on the subject will he be able to explain why a pig iron of such and such an analysis did not show the fracture it ought to have exhibited; not to speak of the very frequent failures to predict the analysis correctly. One often runs across instances of nice open coarsely crystalline pigs which would be judged to contain 3 per cent of silicon, and only show 1.50 per cent. How about soft castings from this?

However, Dr. Kirk's descriptions are interesting enough nevertheless. Here is the so-called No. 1: The fracture presents a large crystal of a dark bluish cast; generally runs soft in light and in heavy work, but in the latter is very open and porous, and does not give a bright surface when finished. For finished work it has to be mixed with scrap or pig having a smaller crystal.

A number two iron has a small crystal similar to that of a mottled iron, but without the thread-like streaks within the crystals. This iron runs soft and very close in heavy work, gives a fine finished surface in planed, turned or bored work, but generally runs hard in light castings.

A very hard pig iron has a very small whitish crystal, giving to the fresh fracture a whitish appearance. This iron runs very hard in light as well as heavy work. In a mottled iron we find a larger crystal of a bluish cast, with white thread-like streaks winding around among the crystals. This iron generally runs strong and close in heavy work, but very hard in light work.

On silver gray iron we find a very small crystal similar to that of a white iron, and it is only distinguished from it by the silvery gray cast. This iron runs very soft in either light or heavy work, but is so rotten in the pig and when cast that it cannot be used alone for either light or heavy work.

The charcoal irons have a different shaped crystal from the anthracite or coke irons. It is smaller than that of the No. 1

XUM

iron, more pointed and sharper to the touch than those of any of the grades of these irons. The sharp pointed drawn out crystal indicates strength in the iron.

As a diagnosis of pig iron the above is excellent, but unfortunately Dr. Kirk adds that the fracture indications are changed only very little by variations in the impurities; and for this reason, the founder cannot always make a casting suitable for the work required from it presumably even if the fracture is suitable. Here he is right, and this is the gist of the whole discussion anent the use of chemistry in the foundry, now going on these last years. If one cannot be certain of results when buying iron by fracture, why not see if buying by analysis only will not meet the requirements? The fact that close upon half of the important foundries of this country are actually doing this with perfect satisfaction is the best answer.

Dr. Kirk adds some further fracture indications in the castings:

In light thin castings the iron when hard is always white or of a very light color; when soft it presents a small crystal and has a grayish blue cast. In heavy work it is white or mottled when very hard, and when not so very hard has a very small crystal with a light grayish cast.

When soft it presents a large crystal with a bluish cast. When the crystals are very large, they indicate an open porous iron that does not polish or finish well. An uneven crystalline structure throughout the fracture indicates an uneven or spotted iron with hard spots that are difficult to machine.

Then follow a number of indications which distinguish cracks or breaks in the castings when occurring before setting, after set, and when cold. These are familiar to our foundrymen and enable them to locate carelessness or mistakes properly and apply the necessary corrections.

Finally come the fractures which show up dirt from the mold, careless skimming, bad pouring, and improper gating, and when limited to the last mentioned indications we will all heartily agree with Dr. Kirk that "These and many more important points in foundry practice are indicated by fracture, and they should all be fully understood by the practical founder and chemist who desires to be a master of the foundry business."

XUM

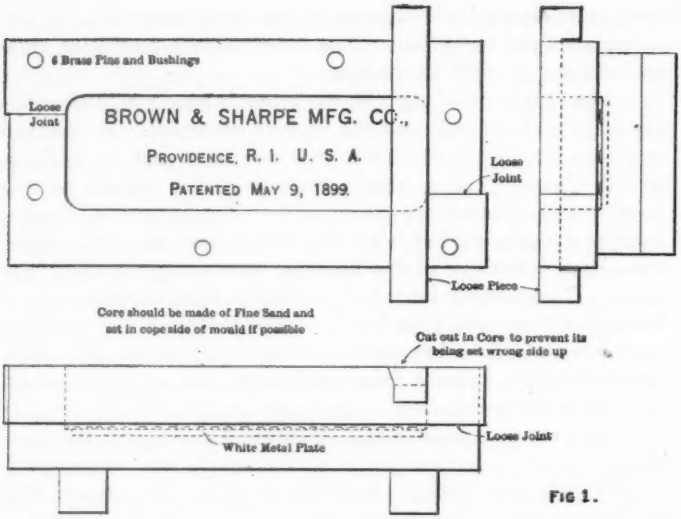

6 Brass Pins and Bushings
Loose Joint
BROWN & SHARPE MFG. CO.,
PROVIDENCE, R. I. U. S. A.
PATENTED MAY 9, 1899.
Loose Joint
Loose Piece
Core should be made of Fine Sand and set in cope side of mould if possible
Cut out in Core to prevent its being set wrong side up
White Metal Plate
Loose Joint

FIG 1.

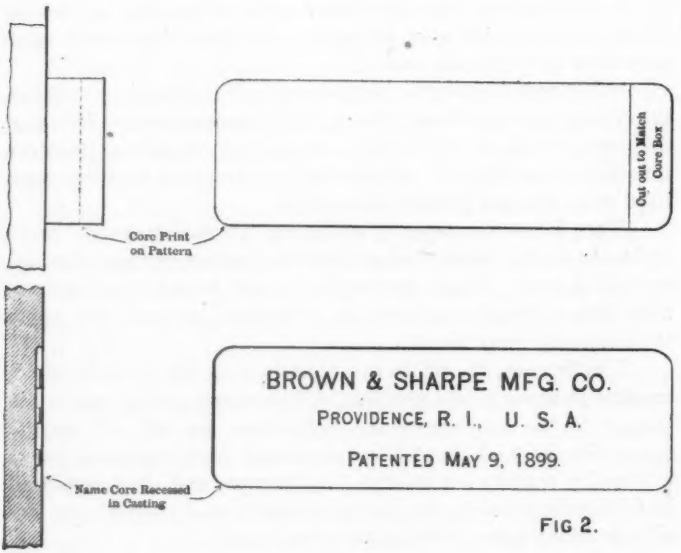

Cut out to Match Core Box
Core Print on Pattern
BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.
PATENTED MAY 9, 1899.
Name Core Recessed in Casting

FIG 2.

## NAME PLATES ON CASTINGS.

*American Machinist*, July 19. Through the courtesy of Mr. Viall, Supt. Brown & Sharpe Mfg Co., the American Machinist is enabled to describe the method of casting the very neat name-plates on the principal castings of their machine tools. The lettering is done by a core, which naturally means a much finer job than the usual molding process. Fig 1 is a sketch of the core box, and Fig 2 shows the pattern with projecting core-print, and, in section, the inset of the name-plate. The projecting thickness of the core-print is less than the thickness of the core, so that when the core is in position in the mold the face of it is within or below the normal surface of the casting, but not so low as to sink the faces of the letters below the casting surface. These preferably project slightly, so that, if desired, they may be ground or otherwise faced. The core, it will be noticed, has a thinner portion on one end, with a corresponding shape provided on the core-print. This prevents setting the core the wrong way and inverting the letters. The core itself should be made very carefully, a very fine core mixture being used next to the letters; a coarser filling can complete it.

## LABOR QUESTIONS IN ENGLAND AND AMERICA.

*Engineering Magazine*, May. Mr. Chas. B. Goring discusses a very serious matter when he reviews the labor questions of the English-speaking world. Mr. J. Stephen Jeans, the noted English economist, propounded this question: Labor being more highly organized in England than in America, is it not by reason of Great Britain's priority as a manufacturing country? If this is so, and it is, will not labor in America become eventually as powerful as in England, and—use this power just as remorselessly? In other words, will the struggle between capital and labor be fought out over and over again in other industrial countries as they become pre-eminent?

Two years ago the industrial battle in England was fought out and a peace established which left little to be desired. Today the trouble is on in America, and only sober reason in the light of clear facts can work out a satisfactory settlement. The trend of things in England at the present time may be well worthy of study in connection with our own coming struggle.

XUM

The workman claims that a reduction in the hours of labor is demanded. He would be in better physical condition to work, could do the work of nine hours in eight, and—there would be a chance to employ more men—which does not fit very well with the second claim. The employer, on the other hand, claims that such a reduction would mean an increase of 5 per cent. to 10 per cent. in the cost of production, that it is impossible to make up for lost time, and in the case of England restrictions as to piece-work, apprentices, overtime, etc., should be either removed, or the wages should be cut down. The last points were, after all, the important ones, for the matter of hours is not so serious. In any adjustment there are always a number of circumstances which require careful consideration. Thus unfilled contracts, established prices, keeping a large plant in long daily idleness. Actual practice under the piece-work system has shown, however, that with proper compensation in the manner of working, the hours of working may be reduced without loss to either side. Mr. Goring thinks that a nine-hour day is the logical one. On this there are different opinions prevalent. He is right, however, in saying that the modern movement is toward larger output with less manual labor—more work from the tool, and less from the man. Be this as it may, the great English strike really rested upon the disguised insistence upon the manufacturers' adoption of trade-union regulations in the operation of their works. This is exactly what America has to face now, and Mr. Goring thinks it is deplorable in the face of the certainty that the freedom and good sense formerly characteristic of the American workingman have been the chief factors in bringing prosperity to him and to his country. Because their workmen were the most productive the United States have won the world's markets for machinery and tools, and now the drag of trade-union working which England has partially freed herself from after bitter and costly effort is facing us here. America has been a gainer by the English strike. She would be a permanent loser by similar trouble here. Germany, more strenuous every day, is a keen competitor, and England is actually experiencing an industrial revolution, for the final agreement which preceded resumption of manufacturing left the British industry practically free from union tyranny. Thus: every workman there is now free to belong to

a union, but every employer is free to employ any man whether union of not. Employers make rates of pay mutually satisfactory to both sides, and determine what disposition is to be made in running their machine tools. Moreover, they may have piecework as much as they like. To us in America this means running an "open shop," which is exactly what is going to be the ultimate outcome of all struggles no matter how fiercely fought.

The best lesson of the British engineering strike is the value of federation, now so well carried out in this country also. Trades unionism has its good points in opposing abuses of the employer's power. In its unwisdom only is it dangerous. On the other side, the manufacturers' federation will go a long way to make a future labor war impossible, because it will be a true friend to employer and workman alike.

**MANUFACTURERS' ASSOCIATIONS, LABOR ASSOCIATIONS, AND ARBITRATION.**

*Engineering Magazine*, May: Mr. H. W. Hoyt, one of the ablest thinkers on modern labor problems, strongly advocates the federation of employers in the United States. He shows that the business peace prevalent in one of the important branches of the iron industry is entirely due to the intelligent co-operation of the employers combined with a relation between them and their employees which is at once fair and satisfactory to both parts.

Mr. Hoyt gives several extracts from the constitution of the National Foundrymen's Association in support of his claim that the industrial organizations, while protecting their own interests, also look very carefully after the welfare of their employees. The fundamental principles of social economics are being looked into so far as they apply to capital and labor, and many practical results have been accomplished from the combined labor of the federations and the trade unions. They stand upon such ground as may be found common to both interests, and branch out after the distrust has become eliminated. The most encouraging sign is the keen sense of responsibility which is felt by the various commissions when assembled to arbitrate a question. There is no trifling or sharp practice indulged in. The local business agent with his petty tyranny is eliminated and a broad national view of the situation taken. Again, these federations are educational, they enlarge the views of the members belonging to them, and so

while the labor organizations have shown manufacturers the necessity of combining for protection, the manufacturers' associations are showing the way to peace with honor.

### "OVERDOING" A DAY'S WORK.

*The Iron Trade Review*, July 26th, comments on a curious anomaly cropping up in the struggle of the Iron Molders' Union to control the organic life of the foundry. It seems that notices are sent out to those who exert themselves too much in the interest of their employers, calling attention to this fact and giving the cheerful information that they will have to stand regular trial for the "offense." The Iron Trade Review rightly characterizes this as the spirit of the Dark Ages entering modern trade unionism. By what measure is a day's work gauged anyhow? Is it by the performance of the weaklings who must needs be protected to the point of receiving a rate of wage no sane employer would pay them unless forced by a stress of circumstances? Would anyone think of hindering his lawyer to overprepare a case or give prizes to the slowest competitor in trials for farm machinery? Yet this is what the Molders' Union is doing. It is laying down laws which mean that the founder should hand over the control of his shop to his employees, and, he himself must fight in a competition with men who work far into the night endeavoring to get up new processes, improvements, all calculated to cheapen production in mass.

Times like the present cannot tolerate this, and the men who are interfered with in their right to work piece-work, over time, or to increase their rate of pay by hard, efficient application, will eventually revolt and cut loose from such foolish and antiquated restraints. The period of the "Faustrecht" is over.

Incidentally, it may be noted that the Supreme Court of New York has decided that to apply the word "scab" to a person is libelous and unlawful, a just decision by men not afraid to alienate votes where justice is concerned.

### WORKS MANAGEMENT FOR MAXIMUM PRODUCTION.

*Engineering Magazine*, May. In view of the interest we are taking in Great Britain's industrial revolution following the disastrous labor war now happily over, an article by Mr. J. Slater

Lewis on the title subject is very welcome. Given a modern plant having all the advantages of a good organization, this can often be neutralized by excessive cost of material and labor, so that in figuring on the introduction of specialized machinery we must take things as we actually find them, say, for instance, the cost of packing and freight, and make only reasonable allowances for future contingencies.

In studying the problems coincident with the title subject, the first thing the Englishman would strike is the trade unions. They must be reckoned with over there. Mr. Lewis reviews the origin and history of trade unionism in England, and intimates that so far as the prosperity of that country is concerned the others should have the same troubles to go through, and the whole result is a uniform status of labor for a fairer competition.

The cost of labor is less on the Contient than in England, for the pay is smaller and the hours of work longer. Compared with America, however, there is less difference on account of the greater output.

The cost of material is of paramount importance to the manufacturer. Where large quantities of heavy materials are used railway siding facilities are absolutely necessary, and short hauls with good unloading facilties are desirable. Where only limited quantities of light materials are consumed the question of material may stand behind that of labor, power, and good markets.

The subject of governmental protection of labor is not so important here as it is in England, yet with all due regard to labor legislation supposed to be for the good of the workingman, and actually burdensome to the manufacturer, the inconvenient inquiry as to the unprotected labor in imported goods seems never to be made. The result of this "protection" is the rapid descent to the point where the question becomes, "What may we do?" instead of "What can we do?"

On the theoretical and technical aspect of the problem Mr. Lewis gives some interesting points. First of all on techical education, which is supposed to be necessary to lead in mass production in the future. He rightly argues that technical education without practice is not going to make a shop pay; on the other hand, when the two go together, the door to success is open. Thus in making guns, the manager must understand not

only the theory of the gun, but be a first-class mechanic as well as know just where to get all the most modern machine tools used in the wholesale manufacture of his specialty. It is necessary to get down to bed-rock with everything entering into the cost, both the technical and the practical items. Hard and fast rules cannot, therefore, be laid down to suit a case, for the introduction of specialized machinery is a thing which must be studied for each problem. To work systematically is to work successfully. Method and a good organization are the two vital forces which, if well directed, mean a permanent success. Unmethodical or slipshod management should not be tolerated, for in many cases establishments have been broken up from within by a failure in the managing machinery.

## PRESERVING POLISHED METALLIC SURFACES.

*Eisen-Zeitung*, No. 28. One of the aggravating circumstances connected with the storing of polished castings is the deleterious influence of the atmosphere; in other words, the castings rust. This is equally the case with iron, steel, copper, brass, bronze, silver, and nickel surfaces; even the packing in imperfectly dried paper suffices to produce a slight tarnish. As a consequence materials of this nature are usually given a thin coat of shellac. The results of such a procedure are, however, by no means satisfactory, as the surface of the metal is often affected and a peculiar iridescence remains, colors are changed, and the high lustre is dimmed.

The best protection is offered by celluloid varnishes, which are colorless, do not affect the polish of the metal, and leave a thin, flexible, and perfectly transparent coat. The easiest way to prepare the varnish is to dissolve colorless celluloid in a mixture of strong alcohol and ether. The celluloid will swell considerably. The mixture is shaken strongly, set at rest for some time, and the clear portion decanted from the residue and used. If desired, aniline colors can be added to produce special tints.

To make the varnish still cheaper, a given quantity of perfectly dry soluble gun cotton is dissolved in ¾ times the weight of ether, and 3-6 times the weight of the strong alcohol. In a few days the solution will be complete. Now add camphor to the extent of ¼ to ½ the original weight of the gun cotton. This mix-

XUM

ture quickly applied to the polished surface gives an excellent coating.

It is necessary to use a few precautions in applying the celluloid varnish. Articles are always better dipped than painted. As soon as the varnish is applied the castings are dried in a chamber at 95 degrees F. As soon as the smell has disappeared they may be packed and shipped. The bath should be of glass or zinc, be sealed hermetically, and kept in a roomy, well ventilated place. If the bath is not perfectly air-tight the remainder of the liquid, after dipping, etc., should be drawn off and kept in bottles.

## RECOVERY OF SHOT.

*The Tradesman*, June 15: Mr. E. H. Putnam discusses one of the small economies of the foundry and calls attention to the growing tendency to saving little things in this country. Herein he is right, for the days when a laborer would throw the bread he did not think fresh enough into the street are rapidly passing, and we all know that the close scrutiny of expenses prevalent during the hard times just passed has not let up at all either. Mr. Putnam uses a magnetic separator to extract iron from the cupola cinder after crushing it in the tumbling barrel. To see what percentage of the shot and iron dust could be recovered in the shape of castings, 905 lbs. of it were meltled. The yield was 798 lbs., a very good result, which goes to show that the impression that iron shot wastes away in remelting is somewhat fallacious. The iron, however, is very hard and were best mixed with a high silicon pig and not over 100 lbs. shot used to the ton. The moral Mr. Putnam draws from the above is that men are not careful enough in handling iron. The man who wilfully ignores the spill-trough and scatters the metal he has left over in the shape of fine shot all over the floor is met with everywhere, yet he should do his share to economize too, and at least if the trough is not available, dump the iron into a depression made in the sand heap. Mr. Putnam rightly argues that employees should co-operate with the employer, for only by doing this is it possible to have satisfactory balance sheets together with good wages. The man who is careful of his employer's property is the man who is taken care of when occasion arises, for who of us does not know how to value the services of every employee to a nicety. Hence Mr. Putnam rightly concludes, "Be careful."

XUM

## HARD SOLDERING CAST IRON.

*Age of Steel*, July 7, describes a new process of hard soldering cast iron. It is based upon the removal of the particles of graphite which prevent the union of the solder with the iron. To prepare the flux make a paste of sub-oxide of copper boiled with borax. Clean the cast iron with acid, apply paste, and heat iron red hot. As the borax melts it protects the iron surface from oxidation and cleans it; the copper sub-oxide in the meantime at this red heat is reduced by the graphite in burning, to pure copper particles. This copper, with the hard solder added, unites with the surface of the cast iron and makes a good joint possible.

## PROPOSED STANDARD SPECIFICATIONS FOR STEEL CASTINGS.

### International Association for Testing Materials, American Section.

Bulletin 16. Those of our members who are actively engaged in the production of steel castings, or are arranging to do so, will be interested in the proposals made by the special committee appointed to draw up standard specifications in this line of work. There will be an open discussion of the matter on Oct. 25-27, 1900, in New York City, and if those who are interested and cannot attend will send their views to your secretary he will present them at the proper time.

### PROPOSED STANDARD SPECIFICATIONS.

1. Steel for castings may be made by the open-hearth, crucible or Bessemer process. Castings to be annealed or unannealed as specified.

2. Ordinary castings, those in which no physical requirements are specified, shall not contain over 0.40 per cent. of carbon, nor over 0.08 per cent. of phosphorus.

3. Castings which are subjected to physical test shall not contain over 0.05 per cent. of phosphorus, nor over 0.05 per cent. of sulphur.

4. Tested castings shall be of three clases: "HARD," "MEDIUM," and "SOFT." The minimum physical qualities required in each class shall be as follows: For hard castings the tensile strength should be 85,000 lbs. per sq. in., the yield point 38,250 lbs. per sq. in., the elongation 15 per cent. in two inches, and the contraction of area 20 per cent. For medium castings

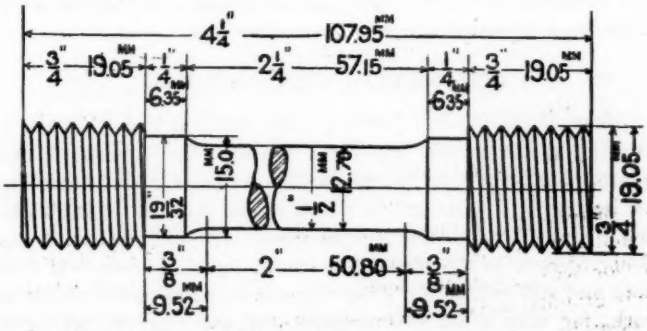
the figures run 70,000, 31,500, 18 per cent and 25 per cent., and similarly for soft castings 60,000, 27,000, 22 per cent. and 30 per cent.

5. A test to destruction may be substituted for the tensile test, in the case of small or unimportant castings, by selecting three castings from a lot. This test shall show the material to be ductile and free from injurious defects, and suitable for the purposes intended. A lot shall consist of all castings from the same melt or blow, annealed in the same furnace charge.

6. Large castings are to be suspended and hammered all over. No cracks, flaws, defects, nor weakness shall appear after such treatment.

7. A specimen one inch by one-half inch shall bend cold around a diameter of one inch without fracture on outside of bent portion, through an angle of 120 degrees for "SOFT" castings, and of 90 degrees for "MEDIUM" castings.

8. The standard turned test specimen, one-half inch diameter and two inch gauged length, shall be used to determine the physical properties specified in paragraph No. 4. It is shown in the following sketch:




9. The number of standard test specimens shall depend upon the character and importance of the castings. A test piece shall be cut cold from a coupon to be molded and cast on some portion of one or more castings from each melt or below or from the sink-heads (in case heads of sufficient size are used). The coupon or sink-head must receive the same treatment as the casting or castings, before the specimen is cut out, and before the coupon or sink-head is removed from the casting.

10. One specimen for bending test one inch by one-half inch shall be cut cold from the coupon or sink-head of the casting or castings specified in paragraph No. 9. The bending test may be made by pressure, or by blows.

11. The yield point specified in paragraph No. 4 shall be determined by the careful observation of the drop of the beam or halt in the gauge of the testing machine.

12. Turnings from the tensile specimen, drillings from the bending specimen, or drillings from the small test ingot, if preferred by the inspector, shall be used to determine whether or not the steel is within the limits in phosphorus and sulphur specified in paragraphs Nos. 2 and 3.

13. Castings shall be true to pattern, free from blemishes, flaws or shrinkage cracks. Bearing surfaces shall be solid, and no porosity shall be allowed in portions where the resistance and value of the casting for the purpose intended will be seriously affected thereby.

14. The inspector representing the purchaser shall have all reasonable facilities afforded to him by the manufacturer to satisfy him that the finished material is furnished in accordance with these specifications. All tests and inspections shall be made at the place of manufacture, prior to shipment.

## OPEN HEARTH STEEL CASTINGS.

*Iron Trade Review*, June 14: Mr. E. C. Wheeler has an interesting article on this important subject. The advance in this industry has been a persistent one, for results are such that they can be regularly guaranteed, which is not the case in malleable iron. Open hearth steel can be made very uniform, as it has plenty of time in the furnace to let the necessary reaction take place and still mix well. This makes it so valuable for electrical work, for with great homogeneity and low carbon an open coarsely granular structure is possible and results are correspondingly desirable. .12 per cent. carbon is usually specified for electrical work.

Steel must be very hot to make successful castings. Again it must be free from blow holes, and shrinkages carefully provided for. Segregation shows itself very plainly in heavy sections also. As may be readily supposed the greatest care is necessary in

XUM

melting, the proportion of gas and air being carefully adjusted so that if anything the gas is slightly in excess. The heat should work slow, the carbon gradually diminishing, and nothing should interfere with the process in the shape of recarburization until the proper time arrives to add the ferromanganese. Care should be exercised in the addition of ferromanganese, for the amount of this depends in some measure upon the class of work made. The molds should be dry and warm to give the best results besides being well vented. If at all possible the castings should be well annealed to relieve all internal strains. If well done the quality is greatly improved. Railroad castings call for 60,000 to 75,000 lbs. per sq. in. tensile strength, with an elongation of 15 per cent. in 8 inches.

The question of proper designs is a serious one, for in the shape of the castings in steel more than any other metal does failure or success lie. We are gradually overcoming the difficulties depending upon the shape of the castings. It is not so long ago that rudder posts, propellers, gears, shafts, etc., gave great trouble and heavy foundry losses. The mechanical treatment, and, we might well add, heat treatment, is all important in determining the final condition of the metal and is often the most expensive part of the whole operation. There are, however, no short cuts to obtain quality so far as we know at present.

The coming improvement will be the casting of steel directly into green sand. It is already carried out in several processes in this country, but is not general yet. To make small casting successfully it is necessary to have high initial heat in the metal, and facings on the mold which will resist it.

Mr. Wheeler points out bridge work as an excellent opening for open hearth cast steel, showing that with the carbon very low the danger from breaks during heavy frosts and shock is not so serious as would be the case with high carbon castings.

## LADLES.

*The Tradesman*, June 15. Mr. E. H. Putnam gives the following advice anent cast or wrought iron foundry ladles. For hand ladles and small bull ladles he advocates cast iron; for shanks of 200 lbs. and over, wrought iron shells with either wrought iron or cast iron bottoms. Large ladles should not have

any cast iron in their construction on account of the danger from cracking when heated suddenly. Mr. Putnam describes the method of putting a cast iron bottom into a wrought iron shell for shanks intended for two or three men. He beds the shell, which has one-half inch holes drilled around near the bottom edge about two inches apart, bottom up in the sand heap. The sand is struck out from the inside a quarter of an inch deep and a fillet cut around the edge to extend just below the holes in the shell. By inserting a tool down the outside of the shell to cover the hole and cleaning out the sand from the inside and then closing up the space left outside the mold is ready for pouring. Before doing this, however, carbon oil is brushed on the iron to prevent spluttering. When poured the iron will run down into the fillet, fill the holes and make a strong, secure bottom one quarter of an inch thick. When Mr. Putnam speaks of wrought iron ladles he doubtless will allow the use of sheet steel in place of the more expensive wrought iron. Again the lightest ladles to-day are those of dished steel, the only place they do not serve well as made now being for light castings, where a strong pour is desired. Again the most successful shank for about 350 lbs. has the bowl made of malleable cast iron, this being thin, light, very strong, and resisting damage by contract with molten iron longer than ordinary cast iron. Indeed a malleable hand ladle is also a good one if shaped shallow and wide if intended for quick pouring. Could Mr. Putnam give us more information on the shape of ladles for varying classes of work?

## INDUSTRIAL DEPRESSION AND THE PIG IRON RESERVE.

*Engineering Magazine*, August. Mr. George H. Hull, the able advocate of the American pig iron storage warrant system, has an article on the title subject which has been so widely discussed that only a brief resume is necessary in these pages. Mr. Hull first explains the difference between an industrial depression and a financial panic. The former results from an abnormal advance in the price of staples, such as building material, which renders an army of men unproductive, reacts upon the high prices eventually, and by causing enormous losses precipitates financial panics. An industrial depression is gradual but long lived and stubborn; a panic is sharp, but short lived. The elements of a depression are reduction of employment, of earnings, of expenditures, of demand and of production, in an endless chain, and the restoration of the equilibrium comes only after years. When all works are earning money, everything produced is absorbed and an immense surplus goes into permanent improvement. This is legitimate prosperity.

To study the cause of the gradual reduction of the earnings of their workingmen, amounting to national calamities, many nations have appointed commissions, and any amount of testimony has been printed, yet the real cause is still a mystery. Everyone who testified did so from his own standpoint; the real undercurrent, passing unnoticed all the time, is only obtained by a careful analysis of the conditions existing in some of the nations contemporaneously which suffered under the terrible depression and did not exist in a similar number of other nations which were free from this trouble. By doing this we find that the pig iron production is at the bottom of the whole matter. Before iron became the preponderating industrial element of nations there were no depressions other than those caused by war, pestilence and famine. Now, however, things are different, and with iron as the acknowledged foundation of our whole industrial system, any serious fluctuation in its production means a disturbance in the entire range of business activity. Iron is a powerful instrument for good when under control, but very potent for

XUM

harm if allowed to advance 80 per cent. to 100 per cent. above its normal cost. The violent and unnecessary fluctuations in the price of pig iron which mean booms are the greatest injury to the producer, for they stimulate the building and reviving of furnaces. Upon the reaction this means ruin and disaster to many and an undue lowering of prices to all. Nearly the entire period of a boom is occupied by the industrial world as a whole in filling low priced contracts. The boom means strikes for higher wages, the reaction again strikes against reductions. The business world as a whole gains nothing by booms, and after all suffers only ultimate loss.

The only way to bring iron under proper control, according to Mr. Hull, is to accumulate a stock of pig iron equal to several months' production, and this in every iron producing country in the world. This would prevent any more booms and reactions, though panics will still occur, but be short lived and not so severe. The manufacturers of building material would then be enabled, by keeping the prices reasonable, to promote a healthy condition of building enterprise, and avert the depression due to outrageous and exacting figures.

To-day the consumption of iron is 400 pounds per capita: 50 years ago it was 100 pounds, and within 25 years it should be 1,000 pounds per capita. The world is not finished; whole continents are to be developed, and every additional producer put to work means more wealth. The act which puts an end to seasons of industrial depression will inaugurate an era of unexampled prosperity to the iron producing nations of the world.

## COMMERCIAL ASPECTS OF LABOR UNIONS.

*The Iron Age*, Aug. 9th. In an editorial headed as above some interesting points are touched upon which are becoming of vital interest to the foundrymen. Unfortunately, like other important economic questions, the problem of labor unions has gotten into politics, which as usual means votes but not a solution. The fact that we have labor unions with us to stay might as well be recognized, but their proper control for the good they can do is desirable, not their suppression. It is not necessary to submit to unreasonable demands, in fact they should be resisted at any cost, for yielding only means to invite newer and

XUM

more unreasonable demands later on. The position of the employer resisting a strike is not so dangerous, as by holding out he invariably secures new men, and the unions must either yield or fall back upon intimidation and violence. The result must always end with interference on the part of the authorities, and much misery which could have been avoided. The boycott and sympathetic strike rarely prove effective, though exasperating all parties and paralyzing business activity.

Worse still, though even more strongly endorsed by the labor unions, are the plans of limiting the output of a worker and placing all employes, drones and workers alike on an absolutely equal basis. The supremacy of the American manufacturer rests upon cheap and abundant raw material, inventive genius and skilled labor. Threaten any one of these three and this supremacy must cease.

The constant attempt of the labor unions is to benefit the incompetent worker at the expense of the skilled one. This means going backward. Where the labor unions establish a high standard of membership and keep out the incompetents there is little danger in this direction; in fact, to belong to such a union would be in itself a recommendation for skill and experience.

Strikes, as a method of settlement, are absolute failures and violation of economic and social laws. They are either accompanied by violence or else are unmeaning protests. They generally fail, and it were well if some method were found to avoid them. The methods usually proposed are arbitration, co-operation and organization by the manufacturers. Until arbitration becomes compulsory it will fail, as no third party can satisfy two others. Co-operation is most promising, but still too experimental. Organization by the manufacturers has proved an effective check upon hasty and unnecessary strikes, as calmer counsels are apt to prevail when it is realized that both parties are well qualified to fight.

The editorial concludes with the statement that "The formation of such organizations among manufacturers for mutual protection and assistance will do more for the time being to prevent strikes and to bring about the proper relations between employers and employes than all the socialistic schemes or legislative enactments with which we are so afflicted."

XUM

## PIECE WORK IN THE MACHINE SHOP.

*Engineering Magazine*, June. In an ably written article Mr. James O'Connell, president of the International Association of Machinists, argues that piece work is not necessary for the best results in the machine shop. It seems that the feeling among union workmen against piece work is so high that discussing it in meeting always precipitates a storm. This must naturally be expected, for we have all seen the molder who insists upon a day's pay of three dollars and puts up about half the number of molds which a piece worker who receives over four dollars for good castings actually does. Moreover, the company is expected to stand the loss.

Nevertheless, Mr. O'Connell advocated the very excellent plans of "premium compensation" devised by Mr. H. M. Norris, but was overruled by the rank and file. The interesting history of this procedure is given at length and includes the nine propositions submitted to vote. These items are so manifestly advantageous to the workingmen that only the fear of their resemblance to regular piece work must have caused them to reject the propositions as a whole. It is a question to-day if manufacturers would be satisfied to grant all of the items anyhow. However, as stated, the whole plan was rejected, and the matter stands as it was. Mr. O'Connell claims that enforcement of piece work breeds disorder in a shop. This is true for a short while only, for when pay-day comes and the hustlers have more coming to them than the foreman gets, while the incompetents quit, the stockholders feel more confident of being able to keep in the market.

Mr. O'Connell states further that the introduction of piece work would bring about some form of limitation of production, and if successfully enforced would lead to retaliative measures on the part of the unions. This is a frank statement, and is valuable as such. The fact that in many branches of the iron trade piece work is the regular thing (even tonnage rates means piece work) shows us why we have been able to capture so much of the world's markets. The danger of limiting production on this account is small indeed. Retaliation, on the other hand, would mean strikes and lockouts, all of which would only help us lose the markets again and reduce the pay-rolls of our shops correspondingly.

XUM

Of course we all know that what Mr. O'Connell says is true: that piece work encourages over exertion, overtime, exploitation, and the sweating system. That it enables some manufacturers to hire more help than they would require, that it makes employment uncertain, leaves a surplus labor market and creates ruinous competition of the unemployed.

With the fearful competition to contend with to-day, however, not only in sales, but in the labor market of other countries, can one blame capital if it pays only for what it receives? It may not be known that sometimes a dozen men putting in time on jobs the year round wipe out the profits which the capital risked in the enterprise is entitled to. There is no element of philanthropy in capital to-day, and if anyone poses as a lover of humanity because he employs labor—at reduced rates—to make stock while the market is dull, he is practicing deception. Only one reason can be given for working during dull times with no immediate prospect of unloading stock—to keep the organization intact and the plant valuable as a producer. Mr. O'Connell thinks that the average American machinist requires no goad to make him do a day's work, yet it is rather strange that in all the skilled trades it is a recognized custom that in a jobbing shop a workman takes off his shirt and hustles, while when working for a company he keeps it on and does not hustle, yet wants the same wages.

Though a goad is not supposed to be needed now, yet a stimulant is said to be necessary soon to keep up the high standard of work. This we are told is a reduction in the hours of work, or at least a trial in that direction.

Where there is standard work, to do this is certainly in the right direction, for the ultimate outcome of a busy manufacturing nation's efforts will be three eight-hour shifts daily for the men and a realization on the part of capital of interest for 22½ hours out of the 24.

## SHRINKAGE.

*The Foundry*, August. Mr. William Roxburgh deals with a subject which every foundryman is interested in all the time. When he speaks of the "absolute shrinkage" in its "secondary form," that is, from the period of set to the cold casting, he could do better by calling it the "contraction," leaving the "shrinkage"

XUM

to fall into the period of the iron from the melted state to the acual setting, about which there can be no question. It is stated that "shrinkage" develops according to the density; that is, cast iron with more metallic iron and less fusible constituents, or impurities, shrinks more than the poorer articles rich in phosphorous, etc. In a sense this is so, for the densest iron we have, the naturally white iron, chilled in addition, has the greatest contraction and shrinkage, too. So far as the fusibility is concerned, however, this iron happens also to be the easiest fusible. It may be readily seen that in the cooling of castings the contraction is along the lines of the principal dimensions, and hence any obstruction from cores or offsets will cause irregularities, which means warping and cracking. Wheels and pulleys show this trouble best, and everyone in the foundry business will have no difficulty in understanding what is meant.

The principal things to look after may be found in the design of the casting, cambering the pattern, slackening in the mold and allowing the iron to cool evenly. In designing work the introduction of ribs should be made only when necessary, and then in such a way that all strains may be balanced properly. Failure to do this means a twisted, if not cracked casting. Warping is often overcome by slightly cambering or arching a pattern when bedding down and clearing away the sand from projections which would interfere with the final contraction. In loam work the rigidness of the mold and core is such that provision must be made to allow a contraction on the part of the casting. This can be accomplished by making good wide joints in the brick work to give flexibility.

Finally, the even cooling of a casting brings up questions which often fall into the field of the designer. Take a belt pulley with a heavy hub. It is often necessary to clean out the core and apply water carefully to cool the hub as fast as the rim. If done judiciously and in a way that the heat can draw back to the bore again, though cooling it considerably, there is no danger of hardness.

On the whole the subject of shrinkage and contraction is an interesting one, though the additional information obtained since the famous investigations on "volumnar contraction," by Mr. Francis Schumann, has been but slight.

XUM

## THE FUTURE OF THE FOUNDRY.

*Iron Trade Review*, Aug. 9th. In an interesting editorial the relation of the molders' union to the ultimate development of the foundry is taken up. The struggle at present going on in Cleveland, when stripped of all detail, is really a question of limiting the output per unit of cost on the part of the unions, and maintaining the free development of the industry on the part of the employers.

Every struggle against the right of the individual to work under the terms on which he will sell his labor will surely come to grief. The laws of supply and demand are inexorable, and sooner or later conditions adjust themselves.

The greatest trouble will come upon the question of piece work. It is coming to be more and more appreciated that the development of the foundry, hinges upon this point in connection with the molding machine. The fact that the unions insist upon running machines by their own men practically means restricted production, and the objection to piece work would seem to be the protection of the weak brother who cannot put up a day's work without great loss of castings.

So far as the development of the foundry is concerned every year sees the engineer coming to the front more and more. Mechanical ideas, not metallurgical ones alone, are giving an impetus to the foundry which bids fair to carry it into the ranks of establishments for mass production at the lowest possible cost.

The introduction of machinery into every department of the foundry, many notable examples being now worked out on this line, will eventually compel even the smallest foundry to look carefully after its disbursements. Metallurgical talent is rapidly codifying the practice of melting iron for specific purposes and incidentally cheapening mixtures. The chief development, however, will be the arrangement of the producing plant in such a way that every piece of continuous labor is performed by a machine. Whoever has had access to carefully kept foundry-shop accounts will notice how quickly costs drop down as the output increases with a given organization. Introduce machinery without increasing the force of men, and a wonderful economy is secured. In this direction will lie the future development of the foundry, and any attempt to check it by arbitrary or artificial means will surely fail.

XUM

## CHARGING CUPOLAS.

*The Foundry*, August. Dr. Edward Kirk describes the process of charging a cupola in great detail. The shavings should be distributed evenly under the wood so that it may ignite at every point at the same time. A layer of wood, split fine, comes next, then coarse wood arranged to burn freely and evenly, and finally the coke. It is important to get a good and even fire, otherwise the melting results will be impaired. When the smoke is gone and the coke bed is beginning to show the fire through the top, the bed is ready for charging. The bed should be about 20 inches above the top of tuyeres with coke and 14 inches with anthracite. A light blast can admit of a lower bed, while a heavy one requires one which is thicker. Experiment with the cupola will soon show this, the best indication being the time required to get melted iron at the spout. This should be three to five minutes after blast is put on. Any length of time beyond this means wasted fuel. It is of course necessary to charge about two hours before blast time so that the stock becomes well heated before settling into the melting zone. When charging begins, finish the front and close up all the tuyeres but one, so that no unnecessary draught may eat up fuel. Two and one-half to three times the weight of the fuel is the rule for the first charge, or say with 1,500 pounds coke for the bed, 4,000 to 5,000 pounds iron for fairly large cupolas. When in doubt about the weight of the first charge, Dr. Kirk advocates making it equal to the fuel bed and gradually increasing or decreasing until the right weight is finally obtained by trial. In the subsequent charges of a heat the fuel is made about 10 per cent. of the charge of iron. So that as a general rule use 3 to 1 for the bed and 10 to 1 for the subsequent charges, depending in this upon the nature and working of your cupola.

Mixing the irons in the charges is an important matter, for in drawing small ladles full at the spout one is apt to get very uneven results, due to imperfect mixing of the melting components of a charge. The pigs should be placed end on to the lining so that they get the full benefit of the melting heat and do not lodge over the tuyeres. Broken pig is better than long pieces for quick even melting. When the charges are heavy divide them and pile a layer of pig on the fuel and over this a layer of scrap, then fuel,

XUM

pig and scrap and so on. If the scrap used is too heavy, it should go directly on the fuel bed and the pig over it. When lighter it may be mixed with the pig, and, when very light, with the sprues to be remelted. Placing thin plate scrap on the fuel protects it from crushing when pig iron is dropped upon it.

## PIECE WORK.

*The Ironmonger*, Aug. 11th. It may interest our American readers to know something about the extent to which piece work prevails in British industries. An official report prepared by Mr. Llewellyn Smith, of the Board of Trade, shows that 26 per cent. of the working population of Great Britain are engaged in occupations which are chiefly piece work trades, and 74 per cent. where time work mainly prevails. The report is very thorough, giving some 300 pages of closely printed data gotten up by experts in industrial statistics.

The bulk of the piece work is paid for by standard lists settled, in most cases, by joint conferences between representatives of the employers and the men, and in only comparatively few cases has the sliding scale been adopted. Wages are regulated in this way in the iron industry to a considerable extent and include iron mining, pig iron and manufactured iron and steel trades. It is intimated that in manufactured products subject to violent fluctuations the adjustment of wages by the sliding scale is the simplest and most scientific scheme yet devised.

## BURNS.

*The Tradesman*, Aug. 1. Mr. E. H. Putnam discusses a matter to which our attention is only too often directed. Hardly a day passes in a large foundry without an accidental burning to one of the molders or helpers. To relieve the pain Mr. Putnam recommends the immediate and plentiful application of cold water, and after witnessing the precipitate flight of a Slavonic laborer some time ago who was badly burned, right over the river bank into the cool and deep waters of the Ohio, your secretary is inclined to agree with Mr. Putnam so far as the first relief of the injured is concerned. The best remedy for the terrible pain of a

XUM

burn is said to be a strong solution of picric acid, which should be applied copiously. Any druggist can prepare this, and it can be kept in a stock bottle for emergency use. Another remedy which should be at hand in every foundry is a large bottle of raw linseed oil, to every fluid ounce of which eight drops of carbolic acid have been added. This oil is applied in the case of cuts, burns, bruises and the sores produced by vitriol and other pickling acids. A supply of antiseptic cotton and roll bandages will be found very useful.

Another chemical which is very useful in cleansing out festering sores of burns and other injuries is peroxide of hydrogen greatly diluted with water (say a 10 per cent. solution). This will oxidize the decayed matter in a wound (if used concentrated one can actually see the process) and leave a clean wound upon which the above mentioned oil can be used to great advantage.

The matter of emergency treatment is a serious one, and it is indeed a gratifying statement to hear that when the regular physician arrives on the scene of accident he finds the sufferer as comfortable as he can be made under the circumstances.

## EXPANSION OF IRON BY HEATING.

*Baumaterialienkunde*, 12, gives some recent results obtained by MM. Le Chatelier and Chantepic and published in the Comptes Rendus. Without going into the detailed figures specially, it may be said that the co-efficient of expansion for irons and steels ranging from .06 carbon up to 1.21 per cent. varied but slightly for the same degree of heat. The co-efficient itself, however, increased rapidly with the temperature. Thus at 32 degrees Fahr. it is .000006, and at 1,400 degrees Fahr. it is nearly .000010, averaging .000008 over the whole range.

The point of interest for foundrymen lies in the fact that were the above figures applicable to cast iron—and they certainly have a bearing upon it—it would mean that from the point of set in a mold (say at 2200 degrees Fahr.) down to coldness the iron could contract roughly 1-5 inch to the foot. The separating out of graphite of course reduces the contraction materially in the case of gray iron. Those who cast white iron will readily see that iron with about three times as much carbon as

XUM

the samples experimented upon, provided the silicon is low enough to leave it in the combined state, follows similar laws as ordinary steels in expanding and contracting, and therefore what is usually termed shrinkage in a casting is only a simple contraction. Shrinkage is really a local drawing or tearing away of metal due to the powerful contractive forces set free in the act of set.

## MALLEABLE IRON SOLD AS STEEL.

*Age of Steel*, Aug. 11, has a memorandum to the effect that some small supposedly steel castings were broken and turned out to be malleable cast iron. The railroad company, upon remonstrating, received the broken pieces back from the makers with the fracture changed to a fine tool steel grain. Further experiments on the part of the purchaser developed the fact that a piece of malleable cast iron, when heated and quenched, showed all the characteristics of tool steel.

The above is interesting from more than one standpoint. That malleable castings should be sold for steel without further treatment is a deception practiced only too often, as your secretary has reason to know from his professional standpoint as malleable expert. That malleable may generally (not always) be changed in fracture to look like the best tool steel is known, or should be known to all malleable men. That the strength is not there, however, is often found from sad experience when warped castings are straightened hot. That, however, malleable castings properly case-hardened when used for cutting tools on soft materials, such as wood, are just as good as steel ones, and very much cheaper, is not generally known. As a matter of fact a milling cutter cast in malleable over size, properly milled out and finally hardened in one of the case hardening processes, will be cheaper than the ordinary tool steel cutters, and outlast them if used on wood.

It may be interesting, if not new, to note that in Central New York State, wood working tools have been made of malleable 30 years ago, if reports are true. They were sold as cast steel.

XUM

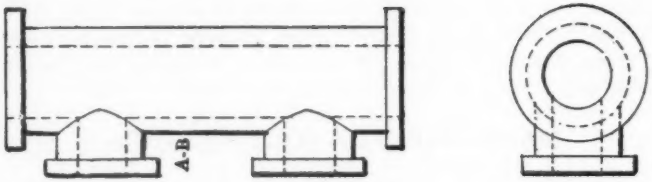



Fig. 1

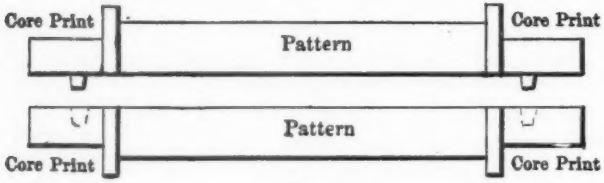



Fig. 2

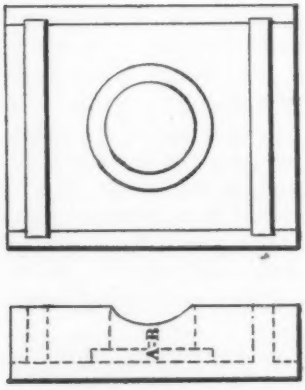



Fig. 3

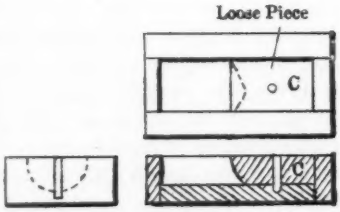



Fig. 4

## ADAPTING PIPE PATTERNS.

*American Machinist*, June 21st has a friend who calls himself "Hobo," a man we all knew when we started our foundries, but who has very good ideas acquired in consequence thereof. They had an eight-inch pipe casting with two six-inch branches to make, with an old split pattern for the straight part having the proper dimensions, in stock. Fig. 1 shows what was wanted and Fig. 2 the pattern. The cores for the branches were formed in Fig. 3 as shown, AB in Figs. 1 and 3 being the same. The branches being placed in the center of the box, face down, and a suitable strickle provided. Fig. 4 shows the half round box for the branch cores, which are pasted the usual way, the loose piece, C, cut to the radius of the core, giving the correct distance from the end.

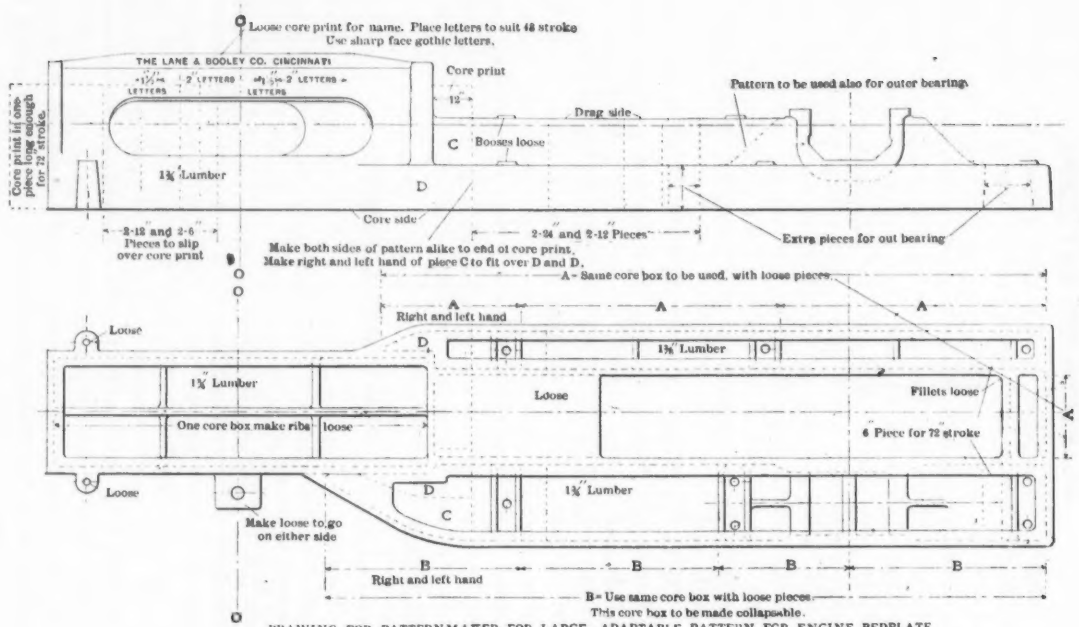
The molder leveled up a bed on the floor, set up the cores for forming the branches, lining them up with straight edges. Half the pattern was now laid on the cores, joint up, and the branches properly located. The mold was now rammed up, the other half pattern laid on, the cope rammed up, lifted up and the pattern withdrawn. The branch cores were now set and properly centered, four spring chaplets keeping them from shifting, and loose sand sprinkled on top, insuring the body core, made with the regular core box, a good bearing. The cope was now fastened down and the job completed.

## FOUNDRY MANAGEMENT.

*Engineering Magazine*, August. In an editorial, attention is called to the strange neglect of foundry requirements when compared with the study and discussion of machine shop problems. While the United States has some excellent examples of advanced foundry management, notably in some of the modern plants, yet there is very much to be desired in the way of cheapening output. The visitor to American machine shops is led through elaborately equipped rooms full of modern tools only to be told that "our foundry is very old-fashioned."

The above homily is based upon Mr. James A. Murphy's paper on "Foundry Management" (read before the American Foundrymen's Association in convention at Chicago), which is given in abstract in the magazine.

XUM

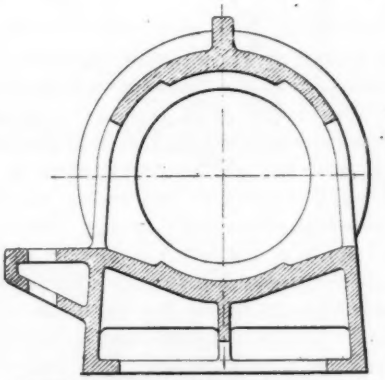



DRAWING FOR PATTERNMAKER FOR LARGE, ADAPTABLE PATTERN FOR ENGINE BEDPLATE.

## ADAPTABLE PATTERNS.

*American Machinist*, Aug. 9, presents an article by Mr. W. S. Hawker, which describes the adjustable pattern for an engine frame which can be used for 12 different engines. The stroke can run from 30 to 72 inches and the engine may be either right or left hand for all of the strokes. The pattern was made by the Dayton Pattern and Model Works, of Dayton, Ohio. The drawing given herewith shows the general construction and method adopted for shaping the pattern for different strokes.

For the cross-head slide housing a half core box was used, and arranged to reverse for the two lengths of opening in the



SECTION THROUGH CROSSHEAD HOUSING ON O O.

sides. In order to shorten up, and internal flange of the cylinder end is moved and loose sections of metal removed from the box proper, which was worked straight through the size of the end core prints. The end prints being carried to the bottom of the bed in the form of tail prints, a filling-in core which can be moved up on the main core at any point when the pattern is shortened up must be provided. The core under the cross-head slides is made in a box having only sides and ends, the upper curved outline being swept out. The core is hung on the cope. The core boxes for the ends of the square frame portions are made to reverse for right or left engine by means of loose pieces forming the outside outlines fitting into a square box. The pillow block

cores are made from a half box extending from the center to each end, a loose piece being inserted for the low outer end. This same box also serves for the pillow block when detached from the frame pattern and used as an independent outer bearing. The straight sections of the side pipes, as well as the outer end, are made from one box, stopping off to the correct length. All cores, from the cross-head housing outward, are supported on chaplets and cut through on the cope side, no print being used. Shrinkage allowance of 1-16 inch per foot is made in the length of the pattern. Finish allowance for boring and planing is ¼-inch and ⅜-inch.

## GATING IN BRASS FOUNDING.

*American Machinist*, June 28th. Mr. C. Vickers discusses the question of gating up brass castings properly, pointing out the fact that brass, bronze and aluminum require different methods to get the best results. Fig. 1 shows a casting frequently met with in brass foundries, which, if of tolerably large size, say over 1½ inch in diameter and between 12 and 24 inches long, shrinks very heavily if gated on one end in the ordinary way. Pouring very hot will give a dirty casting. How to overcome the shrinkage is shown in Fig. 2. A is the riser and B connected with A by a tapering channel cut in the cope is the sprue. The point of junction between A and B is made very small in order to skim the metal. The riser should slightly exceed the diameter of the casting, so that it may set last. The gate connecting the riser with the casting is made very large and in position as shown.

While some brass molders avoid the use of risers altogether they are valuable enough if properly placed. Mr. Vickers never places them on top of a casting if they can be connected with a suitable gate, for there would be a dirty spot in evidence where the riser cast on directly is cut off.

Fig. 3 shows this more fully. The square box strengthened by external pillars of solid metal has a heavy hub in the center which is re-enforced by special brackets. The walls of the box being only ¼ inch it is necessary to feed the hub by proper risers. If the box were to be made of bronze it could be molded hub down successfully, but being made of aluminum it had to be made in a three part flask as shown in Fig. 4. Mr. Vickers next describes the casting of a sample ring about 10 inches in diameter

and 4 inches thick. This requires a riser about 3 inches in diameter and at least 5 inches high, connected to the casting by a gate 1½ inches deep and 1¼ inches wide; this in addition to the regular sprue of 1 inch diameter with a very small gate. A suitably placed riser to provide for the extra metal used in counteracting shrinkage, and a small gate to keep a good head of metal while pouring, are the desirable things for brass casting work.

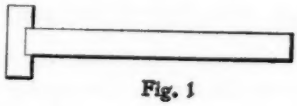


Fig. 1

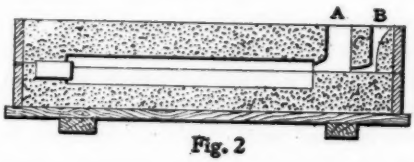



Fig. 2

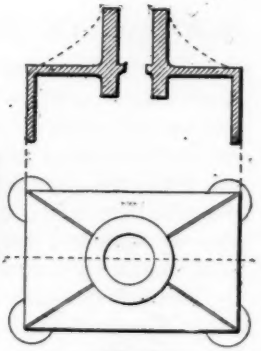


Fig. 3

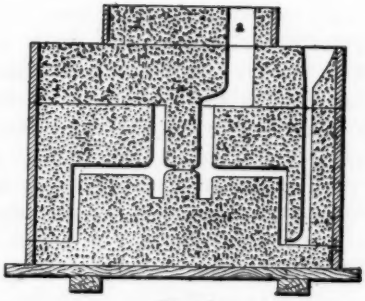



Fig. 4

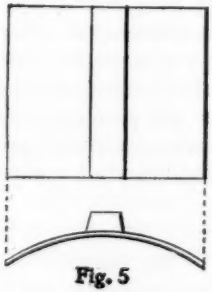


Fig. 5

In casting a heavy chunk, say a brick, it is well to place gate and riser at opposite ends, or by slightly inclining the mold place them both at the highest point, using a 3-inch diameter riser 4 inches high and instead of cutting the gate into the riser or directly into the casting so that the metal will roll down the inclined mold, run a small channel from the sprue down to the

lowest point of the mold and cut a small gate. The metal then enters at the lowest end, fills that and gradually and gently advances up the incline, until the cavity is filled, and then into the riser, carrying there any of the dirt that it may have gathered.

Fig. 5 is an arched plate with a heavy rib across the center. It was molded rib up, a small spray gate was cut at one end of the plate, a 2½-inch riser at one end of the rib and connected with a good sized gate. Pouring fairly cool left nothing to be desired.

## ELECTROLYTIC CORROSION OF CAST IRON PIPE.

*Cassier's Magazine*, August. One hears so much of the electrolysis of underground pipes that it is very interesting to note the comparative freedom of underground cast iron water and gas mains from this annoyance. Brooklyn, with its numerous trolley lines, furnishes this experience. Only two instances of trouble with the 755 miles of cast iron gas main were observed, while wrought iron pipe, malleable and brass fittings were sometimes completely destroyed in three years.

Mr. S. Sheldon, in a paper prepared for the American Institute of Electrical Engineers, describes the experiments made to discover the reason for this apparent immunity on the part of cast iron from the effects of stray currents. It seems that in testing the pipes for occluded gases in the pores of the skin, it was discovered that in casting them there is a thin coating of silicate of iron formed on the surface, which is a non-conductor of electricity. This, together with a good coat of asphaltum, accounts for the peculiar resistance to the passage of the current. If, however, a heavy current is once sent through the coating at one spot, the whole surface becomes amenable to the usual corrosion.

## CUPOLA PRACTICE.

*The Foundry*, August. Mr. Edward B. Gilmour discusses the cupola from the standpoint of the distribution of the blast. It is necessary to have a good combustion in order to get efficiency. Even in good practice about 25 per cent. of the heat units are lost. Too much blast means waste of fuel and scaffolding, while too little practically sends burning producer gas out of the stack. Mr. Gilmour advocates throwing two or three shovelfuls of small bituminous coal into the cupola before drop-

XUM

ping bottom. This causes an intense heat and collects much of the slag from the sides and saves subsequent chipping.

An English investigator, Mr. Hart, studied the atmospheric effects upon cupola practice, both for blast furnace and cupola, and found that unfavorable conditions due to heat and pressure might reduce the efficiency of the operation 10 per cent. So far as moisture in the air goes this question is also serious, and great loss of heat results from blowing in a lot of water with the air for melting iron.

Mr. Gilmour finally describes a new cupola having six rows of tuyeres with six inlets in each row and so arranged that any Colliau or Whiting cupola can be readily transferred into it if desired. It is claimed that good hot iron for machinery castings can be made in this way with a ratio of 10 to 1, which is doubtless correct, as the principle is in line with that of the Hungarian cupola of Greiner and Erpf, of Chisnyoviz, though much simpler. It would, however, be interesting to know if the upper two rows of tuyeres help in the actual heating of the charge, and if the air itself is distributed as evenly as in the Whiting or Colliau.

## MIXING IRON.

*The Foundry*, September. Dr. Edward Kirk discusses the difficulties attending the proper mixing of melting irons. He claims that when molten irons of different grades are brought together they do not mix by any means, but form an unreliable compound. The example of the blast furnace is quoted, where an accumulation of six to twelve hours results in a cast of widely varying constituents. Mere contact does not mix fluid bodies thoroughly, hence the desired result should be obtained by a shaking up of the particles in the process used. Dr. Kirk therefore argues that it is a mistake to provide too much room in the cupola for collecting melted iron before tapping (and where very uniform castings are desired he is certainly right), but taps should be made often to allow the running particles to mix thoroughly as they leave the cupola. Moreover the charge should consist of small enough pieces of pig and scrap that the melting iron trickling down may unite and the hard and soft varieties blend well. One often sees nodules of a burnt iron imbedded in the regular soft casting, and the reviewer remembers running across gray nodules of rich silicon iron in a lot of white iron castings where a softener

XUM

had been used too freely. Furthermore Dr. Kirk very properly advises the mixing of irons which are not too extreme in their properties but run as near the composition of the work required as is allowable. Thus a No. 6 iron mixed with ferrosilicon would give proper results theoretically, but in practice they do not mix well. The best results are always obtained by keeping the iron in continuous motion from the time it is melted until poured. This method used for stove and bench work gives a perfectly even iron and the stream from the cupola runs continuously. A bull ladle so arranged to fill up hand ladles while the stream from the cupola empties into it uninterruptedly will provide for irregular pouring. Melt the iron fast and hot and pour as hot as the work will stand it.

## PATCHING CASTINGS BY THE GOLDSCHMIDT PROCESS.

*Engineering and Mining Journal,* Aug. 25. The process of generating intense heat through the combustion of aluminum, invented by Dr. Goldschmidt, has recently been pretty well exploited in the technical press. The article by Mr. S. B. Archdeacon in the above named journal is about the most complete and up-to-date that has yet appeared. Only that portion of it which may interest foundrymen will be reviewed.

On bringing aluminum together with oxygen an intense heat is generated. The chemical reaction is very energetic and a temperature hitherto obtained only by electrical means is almost instantaneously attained. The aluminum is used powdered and the oxygen is obtained from a metallic oxide such as the oxide of iron. A crucible lined with alumina forms the best piece of apparatus in which to carry out the process.

In order to ignite the mixture a high temperature is necessary. Oxygen taken from some superoxide at a comparatively low temperature will help to do this, and so by using a mixture of aluminum powder with barium superoxide as a fuse the whole reaction can be started off with an ordinary match. Once started the operation may be prolonged at the will of the operator by simply heaping on more of the mixture. About 5400° F. are obtained. The process is simple, an intense heat can be applied to a desired spot without costly apparatus, and the expense is not great at present prices of aluminum.

XUM

The use of this new heating process is for reducing chromium and manganese in a pure state from the oxides, for welding large and small wrought iron water pipes, welding rails, and repairing faulty shafting, steel castings, etc. The last named application will only interest the steel founder. In conducting the process in a crucible there is found a regulus of steel at the bottom and a slag covering it. The charge in the first place consists of a mixture of aluminum and oxide of iron, patented under the name of "Thermit." The crack or defective place in the casting is first covered by a small form of sheet iron surrounded by molding sand. The slag is now poured away, leaving the regulus behind in the crucible. This regulus, which is intensely overheated, is now quickly poured on the fault or crack and the whole gradually allowed to cool before removing the mold. A better weld is obtained by first heating the defective spot by incandescent coke. Shaping or planing off the surplus metal leaves the casting ready for use. A number of illustrations are included in the paper.

## FOUNDRY SPECIFICATIONS FOR PIG IRON AND SCRAP.

We are indebted to our friend and fellow member, Mr. E. H. Walker, foundry manager for the J. I. Case Threshing Machine Co., Racine, Wis., for a copy of their iron and coke specifications. These specifications are the combined work of Mr. W. G. Scott, the chemist, and Mr. Walker, and are commended as a very conservative and safe exposition of the needs of a modern foundry. The following is a summary of the requirements:

| Foundry Irons. | No. 1. | No. 2. | No. 3. |
|---|---|---|---|
| Silicon, not below | 2.50 | 1.95 | 1.35 |
| Sulphur, not over | .03 | .04 | .05 |
| Phosphorus, not over | .60 | .70 | .80 |
| Manganese, not over | .50 | .70 | .90 |

Total carbon not specified in any of the above. All pig irons bought by analysis and mixed in the same manner. Every car is carefully sampled and analysis noted. Rejected cars subject to shipper's order. Silicons running more that .10 below specifications will cause rejection of the carload, similarly sulphur over .005 above the limit given. The A. F. A. standardized drillings

serve as "standards" in case of dispute, and the methods used in the J. I. Case T. M. Co.'s laboratory are given:

| Special Pig Irons. | Silver Gray. | Ferrosilicon. | Manganese Pig. |
|---|---|---|---|
| Silicon ..... | 3.00 to 5.50 | 7.00 to 12.50 | over 2.50 |
| Sulphur, not over..... | .04 | .04 | .04 |
| Phosphorus, not over... | .90 | .. | .70 |
| Manganese, not under.. | .30 | .. | 90 to 2.50 |
| Total Carbon, not under | 2.50 | .. | .. |

For malleable Bessemer pig iron the following is specified: A straight Bessemer having the phosphorus limit at .10%, while the common malleable Bessemer may have phosphorus up to .150. Variations in the constituents are allowed only .10% either way for silicon and manganese. Sulphur over .05 and phosphorus over .18 means absolute rejection.

In calling for charcoal irons silicon is asked for from .30 to 2.75 sulphur not over .025, phosphorus not over .250, manganese not over .70 and carbon with the usual range of about 2.50 to 4.50%.

Phosphoric pig irons, used entirely for small thin castings, should run as follows: Silicon not under 1.50%; phosphorus not under 1.00%; sulphur not over .055%, and manganese from .30 to .90, carbon being not under 3%.

A few timely "remarks" on the subject of depth of chill in charcoal irons, effect of manganese and phosphorus, round off this really excellent set of specifications, which may seem a little strict in some respects, but are not at all burdensome to the furnace man who has good iron to sell.

In regard to the machinery scrap used, the specifications call for good, clean material made up of agricultural implements and light machinery scrap. No malleable, wrought, steel, stove plate, grate bar, roll or brake shoe scrap is wanted, and the material should not be too rusty. 400 lbs. is the limit of weight of any piece accepted.

The specifications for foundry coke call for a good, clean 72-hour grade, in which the "black heads" are limited to the percentage usually found in No. 1 "selected" foundry coke. It should be massive, reasonably free from granulation, dust and cinder.

Coke will be rejected if sulphur is over .85%; phosphorus if over .05%; fixed carbon if less than 85%, and ash if less than 5%.

XUM

## BRANDS *vs.* ANALYSIS.

*American Manufacturer*, Dec. 13th. A short interesting editorial contrasts the old method of purchasing pig iron for the foundry with the new. Many foundrymen still pay a higher price for the reliable old brands of iron they have used for years rather than try new and cheaper ones. The larger foundries having laboratories reap a nice return here, for they buy in the open market on chemical specifications and save a dollar a ton thereby occasionally. This saving pays the cost of a laboratory many times over in some instances, and should be considered very carefully.

In justice to the makers of "honest" irons the reviewer would say that chemical specifications ought to be supplemented by physical tests to insure a high quality for strength, etc., along with a given composition, as not all irons of the same analysis are alike. Those who come in daily contact with pig iron salesmen will be glad to learn that the bulk of foundry pig iron is now sold by analysis; fracture specifications are beginning to fall off, for the advanced foundryman has learnt that he who specifies and sees that he gets what he wants gets the cream; the others get beautiful fractures and mixed compositions.

## RECOVERING SHOT IRON.

*The Iron Trade Review*, Dec. 13th. In a paper read before the Progressive Foundry Club, Mr. W. W. Sly discusses the difficulties encountered in recovering the iron lost about the foundry in the form of shot. Numerous tests with the old-fashioned stave mill for rolling the cinder, etc., show that the dirt from them yields from 20 to 35 per cent. of good iron, and modern methods of economy should be adopted to save this loss. One method is to winnow the dirt, blowing the dust away and leaving the heavy particles. This is a very dirty way to do it for the comfort and appearance of the plant. Magnetic separation, Mr. Sly says, be-

XUM

sides attracting the iron, also attracts the sulphides, and hence the result is not especially beneficial to the succeeding mixture. The cost of the current is also heavy.

Mr. Sly now traces the cupola waste from the dropping of the bottom and concludes that a single operation must finish the work of recovering the shot and also waste coke, to be at all economical. This, he says, is only done with the water mill, which gives the iron clean and free from the protecting crust of oxides and silicates which tend to keep the globules intact even if melted and thus make the hard spots in the castings.

## REINFORCED CAST IRON PIPES.

*Engineering and Mining Journal*, Nov. 17th, notes the awarding of a prize at the Paris Exposition to a company in France with a name of fourteen words for cast iron pipes which were strengthened with steel hoops. The pipes are cast vertically and of ordinary iron. They have external transverse ribs on which rolled steel hoops are shrunk. A number of trials has shown that a normal cast iron pipe thus strengthened can stand violent shock and heavy internal pressures very much better than the ordinary product. In fact the extra metal which would otherwise be necessary to make a safe cast iron pipe job is far more expensive than the strengthening hoops. Moreover, in case of a break the loss of water in the ordinary pipe which gives way completely is also greater than in the reinforced pipe, where only a small part can come out.

## CAST IRON CAR WHEELS.

*Engineering News*, Oct. 18th. Mr. G. W. Beebe calculates that there are ten and a quarter millions of cast iron wheels in use on our railroads to-day. The damage done by the failure of cast iron wheels is so slight that their manufacture may be said to approach a science. Here is a case where the application of the drop and thermal test has done much to bring out this state of efficiency. The thermal test has often been complained of by manufacturers because it compels them to make wheels which to stand it are not as good in their wearing qualities as they should be. However, with reasonable specifications this is not so serious.

XUM

The specifications of the C. B. & Q. R. R. are given in full for the thermal test which, in connection with the Barr drop test, will insure the railroads the greatest degree of safety in buying their wheels. Some good advice is given the inspectors, who are told to study iron so that they may know whether a test wheel fails from some unforeseen cause due to the annealing or other treatment, or from inherent weakness. In this way the inspector will not reject an otherwise good batch. The wheels with the greatest shrinkage always being the weaker ones, the inspector usually selects one of these for his tests, and if it passes he is reasonably certain that the others can come up to the required test also. For good wearing qualities a tough chilled wheel is required. A hard close grained iron may stand concussion in service all right, but will fail under continued and severe brake application. It is necessary to keep the sulphur down, otherwise hard gritty wheels will result which will fail to pass the thermal test of pouring melted iron around the tread and noting the effect two minutes later.

To show the improvement made in recent years Mr. Beebe states that in 1893 the number of blows under the drop test required to break a wheel averaged 24. To-day they stand 165. It is well not to get the chill too deep, for this means shelled spots; in fact on breaking up 300 defective wheels removed for this trouble 95 per cent. were found with a high chill. Much trouble is also caused by defective machine work in mounting wheels, too heavy a pressure is often necessary to put the wheels on the axles, and strains and trouble result.

The following recommendations are made by Mr. Beebe: More attention should be paid to taping wheels on the same axle, and when wheels are remounted they should be measured again to see if they are exactly alike in circumference. All axles should be centered and gauged. The wheels should be pressed on carefully and to their exact place. In boring wheels a rough and a finishing cut should be taken, and not only one cut as is done in many contract shops. When practical, wheels of the same manufacture should be placed on the same axle. The designing of the wheel is best done by the manufacturer, as he will know best how to proportion the wheel to give the best service.

It is necessary to pour the wheel hot and fast, otherwise there will be trouble from seams in the tread, internal strains and uneven chill. The maximum limit of pouring a 33-inch wheel

XUM

should be not over 12 seconds. The faster the wheels get to the annealing pits the better. A table of analyses of wheels which were tested under the drop and thermal tests is given. Some passed and others failed, yet their composition is the same. This shows the necessity of watching the mechanical end of the operation closely with a given proper mixture.

In discussing Mr. Beebe's paper Mr. G. R. Henderson, of the C. & N. W. Rr., called attention to the fact that the tables presented were not altogether a source of comfort. It is very difficult to get up a chemical specification for a wheel and then have it stand up as expected. After a careful series of tests the following chemical specifications were issued for the wheels used on Mr. Henderson's road: Total carbon, 3.25 to 3.75; graphite, 2.75 to 3.00; combined carbon, .50 to .75; sulphur, .05 to .08; manganese, .30 to .50; silicon, .50 to .75, and phosphorus, .35 to .45. The introduction of the thermal test has made quite a change in the question of manganese, for an addition of this in the shape of ferromanganese will enable a wheel to stand a better chance of passing. A wheel of what was a good ordinary iron mixture would crack in half a second when subjected to this test, but the addition of one quarter to one per cent. of ferromanganese would let the wheel remain 15 to 20 minutes before cracking, and sometimes it got cold without a break. The ferromanganese is added in powdered form just before the cast, and its effect is certainly beneficial. Mr. Delano added his testimony to the effect that the manufacture of car wheels of cast iron has reached a wonderful state of perfection to-day.

Mr. Asa W. Whitney adds a few notes to the above in The Iron Trade Review of Nov. 22, indicating that there is afield for metallography in foundry work particularly with hard irons. Giving limits in the percentage of each element is misleading and should not therefore condemn the use of chemical analysis in car wheel work. Chemical analysis, together with physical tests, alone give satisfactory clues to the troubles encountered. The addition of ferromanganse is a dangerous thing, even one-tenth of one per cent. should be sufficient, one-fourth of one per cent. being too much. Too high manganese makes the chill too brittle even if deep enough.

XUM

## IRON AND PHOSPHORUS.

*The Iron and Coal Trade Review*, Sept. 21. The iron world has been anxiously awaiting Mr. J. E. Stead's investigation on the microstructure of iron and steel with special reference to their phosphorus contents. Mr. Stead spent a few years in this research and prepared several hundreds of specimens. His friends in various steel works helped him in this line of research, and, in all, four classes of compounds are made: (a) all compounds with from 0 to 1.70% phosphorus; (b) with 1.70 to 10.2%; (c) with 10.2 to 15.6%; (d) with 15.6 to 21.7% phosphorus. In the first class, which contains all commercial steels and wrought irons that have practically no carbon, the polished specimens when etched darkened relatively with the quantity of phosphorus present. The grains of the solidified ingots also became larger with the crystals, and with 1 per cent. phosphorus present cleavage faces more than one inch in diameter were observed on the fractured material. The other classes show many interesting things to the maker of steel rather than the foundryman.

Mr. Stead has found that phosphorus in iron does not prevent the separation of graphite, but there is a difference in the fracture of a high and a low phosphorus pig iron; with the same combined carbon the high phosphorus iron looked much lighter.

The importance of Mr. Stead's work lies in the discovery of a new method of distinguishing the phosphorus compounds in the iron, and thus giving us a basis for investigating the phenomena of cast iron high or low in this element. The sections are prepared in the usual way by slicing and polishing, and are then "heat-tinted," that is, gradually heated while under the microscope until the various constituents come out in beautiful tints. Thus a white phosphoretic pig iron was prepared for observation, and when heated the pearlite showed up blue, the cementite red, and the iron phosphide yellow. The separation is now fairly easy and very interesting when taken in connection with the well-known tendency toward segregation exhibited by castings high in phosphorus.

The paper of Mr. Stead is an elaborate one, and will repay a careful study by those interested in getting light on a subject little understood but highly important in the industry.

XUM

sides attracting the iron, also attracts the sulphides, and hence the result is not especially beneficial to the succeeding mixture. The cost of the current is also heavy.

Mr. Sly now traces the cupola waste from the dropping of the bottom and concludes that a single operation must finish the work of recovering the shot and also waste coke, to be at all economical. This, he says, is only done with the water mill, which gives the iron clean and free from the protecting crust of oxides and silicates which tend to keep the globules intact even if melted and thus make the hard spots in the castings.

## REINFORCED CAST IRON PIPES.

*Engineering and Mining Journal*, Nov. 17th, notes the awarding of a prize at the Paris Exposition to a company in France with a name of fourteen words for cast iron pipes which were strengthened with steel hoops. The pipes are cast vertically and of ordinary iron. They have external transverse ribs on which rolled steel hoops are shrunk. A number of trials has shown that a normal cast iron pipe thus strengthened can stand violent shock and heavy internal pressures very much better than the ordinary product. In fact the extra metal which would otherwise be necessary to make a safe cast iron pipe job is far more expensive than the strengthening hoops. Moreover, in case of a break the loss of water in the ordinary pipe which gives way completely is also greater than in the reinforced pipe, where only a small part can come out.

## CAST IRON CAR WHEELS.

*Engineering News*, Oct. 18th. Mr. G. W. Beebe calculates that there are ten and a quarter millions of cast iron wheels in use on our railroads to-day. The damage done by the failure of cast iron wheels is so slight that their manufacture may be said to approach a science. Here is a case where the application of the drop and thermal test has done much to bring out this state of efficiency. The thermal test has often been complained of by manufacturers because it compels them to make wheels which to stand it are not as good in their wearing qualities as they should be. However, with reasonable specifications this is not so serious.

XUM

The specifications of the C. B. & Q. R. R. are given in full for the thermal test which, in connection with the Barr drop test, will insure the railroads the greatest degree of safety in buying their wheels. Some good advice is given the inspectors, who are told to study iron so that they may know whether a test wheel fails from some unforeseen cause due to the annealing or other treatment, or from inherent weakness. In this way the inspector will not reject an otherwise good batch. The wheels with the greatest shrinkage always being the weaker ones, the inspector usually selects one of these for his tests, and if it passes he is reasonably certain that the others can come up to the required test also. For good wearing qualities a tough chilled wheel is required. A hard close grained iron may stand concussion in service all right, but will fail under continued and severe brake application. It is necessary to keep the sulphur down, otherwise hard gritty wheels will result which will fail to pass the thermal test of pouring melted iron around the tread and noting the effect two minutes later.

To show the improvement made in recent years Mr. Beebe states that in 1893 the number of blows under the drop test required to break a wheel averaged 24. To-day they stand 165. It is well not to get the chill too deep, for this means shelled spots; in fact on breaking up 300 defective wheels removed for this trouble 95 per cent. were found with a high chill. Much trouble is also caused by defective machine work in mounting wheels, too heavy a pressure is often necessary to put the wheels on the axles, and strains and trouble result.

The following recommendations are made by Mr. Beebe: More attention should be paid to taping wheels on the same axle, and when wheels are remounted they should be measured again to see if they are exactly alike in circumference. All axles should be centered and gauged. The wheels should be pressed on carefully and to their exact place. In boring wheels a rough and a finishing cut should be taken, and not only one cut as is done in many contract shops. When practical, wheels of the same manufacture should be placed on the same axle. The designing of the wheel is best done by the manufacturer, as he will know best how to proportion the wheel to give the best service.

It is necessary to pour the wheel hot and fast, otherwise there will be trouble from seams in the tread, internal strains and uneven chill. The maximum limit of pouring a 33-inch wheel

XUM

should be not over 12 seconds. The faster the wheels get to the annealing pits the better. A table of analyses of wheels which were tested under the drop and thermal tests is given. Some passed and others failed, yet their composition is the same. This shows the necessity of watching the mechanical end of the operation closely with a given proper mixture.

In discussing Mr. Beebe's paper Mr. G. R. Henderson, of the C. & N. W. Rr., called attention to the fact that the tables presented were not altogether a source of comfort. It is very difficult to get up a chemical specification for a wheel and then have it stand up as expected. After a careful series of tests the following chemical specifications were issued for the wheels used on Mr. Henderson's road: Total carbon, 3.25 to 3.75; graphite, 2.75 to 3.00; combined carbon, .50 to .75; sulphur, .05 to .08; manganese, .30 to .50; silicon, .50 to .75, and phosphorus, .35 to .45. The introduction of the thermal test has made quite a change in the question of manganese, for an addition of this in the shape of ferromanganese will enable a wheel to stand a better chance of passing. A wheel of what was a good ordinary iron mixture would crack in half a second when subjected to this test, but the addition of one quarter to one per cent. of ferromanganese would let the wheel remain 15 to 20 minutes before cracking, and sometimes it got cold without a break. The ferromanganese is added in powdered form just before the cast, and its effect is certainly beneficial. Mr. Delano added his testimony to the effect that the manufacture of car wheels of cast iron has reached a wonderful state of perfection to-day.

Mr. Asa W. Whitney adds a few notes to the above in The Iron Trade Review of Nov. 22, indicating that there is afield for metallography in foundry work particularly with hard irons. Giving limits in the percentage of each element is misleading and should not therefore condemn the use of chemical analysis in car wheel work. Chemical analysis, together with physical tests, alone give satisfactory clues to the troubles encountered. The addition of ferromanganse is a dangerous thing, even one-tenth of one per cent. should be sufficient, one-fourth of one per cent. being too much. Too high manganese makes the chill too brittle even if deep enough.

XUM

## IRON AND PHOSPHORUS.

*The Iron and Coal Trade Review*, Sept. 21. The iron world has been anxiously awaiting Mr. J. E. Stead's investigation on the microstructure of iron and steel with special reference to their phosphorus contents. Mr. Stead spent a few years in this research and prepared several hundreds of specimens. His friends in various steel works helped him in this line of research, and, in all, four classes of compounds are made: (a) all compounds with from 0 to 1.70% phosphorus; (b) with 1.70 to 10.2%; (c) with 10.2 to 15.6%; (d) with 15.6 to 21.7% phosphorus. In the first class, which contains all commercial steels and wrought irons that have practically no carbon, the polished specimens when etched darkened relatively with the quantity of phosphorus present. The grains of the solidified ingots also became larger with the crystals, and with 1 per cent. phosphorus present cleavage faces more than one inch in diameter were observed on the fractured material. The other classes show many interesting things to the maker of steel rather than the foundryman.

Mr. Stead has found that phosphorus in iron does not prevent the separation of graphite, but there is a difference in the fracture of a high and a low phosphorus pig iron; with the same combined carbon the high phosphorus iron looked much lighter.

The importance of Mr. Stead's work lies in the discovery of a new method of distinguishing the phosphorus compounds in the iron, and thus giving us a basis for investigating the phenomena of cast iron high or low in this element. The sections are prepared in the usual way by slicing and polishing, and are then "heat-tinted," that is, gradually heated while under the microscope until the various constituents come out in beautiful tints. Thus a white phosphoretic pig iron was prepared for observation, and when heated the pearlite showed up blue, the cementite red, and the iron phosphide yellow. The separation is now fairly easy and very interesting when taken in connection with the well-known tendency toward segregation exhibited by castings high in phosphorus.

The paper of Mr. Stead is an elaborate one, and will repay a careful study by those interested in getting light on a subject little understood but highly important in the industry.

XUM

## OIL AS A FUEL.

*Engineering Magazine*, October. In some parts of this country oil is still used for melting and heating purposes. The figures given in a paper by M. G. de Krivochapkinc, in a recent number of Le Genie Civil, will therefore be of some interest to foundrymen.

In Russia, where oil is cheap, many experiments have been made to obtain the best economy in its use. Noble Bros. being the firm identified most prominently in this line of research and practical exploitation. An experimental demonstration showed that a ton of cast iron could be melted by burning 145.2 lbs. petroleum residue, or about 21 gallons. As in all experiments with oil the chief difficulty lies in providing the proper apparatus, so here also the oil had to be burned in a series of superposed troughs placed at the entrance of the furnace, the oil being kept at a constant level in them by a special device. Air was admitted between the troughs and also above them, no steam or compressed air being required.

The stream of burning gases could be diverted in any way desired, and .6 ton of petroleum residue melted 1 ton steel as compared with 1.5 tons of coal.

In the open hearth furnace matters are so arranged that the regenerators instead of being used for heating the incoming air, gasify and superheat the oil and thus render combustion more complete.

## MALLEABLE CAST IRON.

*Engineering and Mining Journal*, Sept. 8th, has an article on the above subject which is interesting in that it gives the statistics of the production of this special grade of iron. While originally the entire dependence was placed upon the removal of the carbon from the comparatively thin castings made, at the present day the point sought after is the remarkable change of the combined carbon in the white casting to the annealed piece with its "temper carbon" in proper quantity and distribution. In this way American enterprise has built up a wonderful business, and good castings 2 inches thick are made regularly.

The process, first described by Reaumeur in 1722, was specially developed in England where, as in Germany and France,

XUM

many castings are still produced by the crucible process. The contrast between 500 lbs. a day cast from crucibles in Europe, and a modern malleable works in this country with 50 or 75 tons daily capacity, is certainly creditable to us, but will not last long.

Malleable cast iron has a unique position in the iron industry, as it is especially adapted to resist shock, bends before breaking, and is very soft. It is about eight times as strong against shock as cast iron, and has a tensile strength over one-half that of cast steel. Pig irons low in silicon form the bulk of the mixtures used, charcoal being the material preferable, though a good coke iron leaves nothing to be desired. Malleables made in the cupola are hard to anneal on account of the close grain produced by this method of melting. With plenty of coke, however, the lightest castings are readily made. Furnace iron is much better and is more generally used, the capacity of the furnaces ranging from 6 to 15 tons as a rule. The open hearth furnace gives the hottest iron, if properly managed.

The market for "malleables" is reviewed. Hardware, agricultural machinery, other machine parts, pipe fittings, railroad castings, electrical castings, harness work, etc., forming the staples. Large capital is required in embarking in this business so that unless the market is sure it is best left alone.

The article concludes with a resume of the important plants in this country, which are grouped by states, and shows that the normal output of malleable castings yearly is in round numbers 500,000 tons. The combined production of "malleables" of the rest of the world is only 75,000 tons at the outside.

## THE FOUNDRY SHOP COMMITTEE.

*The Iron Trade Review* Oct. 4th. "Overdoing a day's work" was the heading of a recent editorial in this journal, and it brought responses from the Iron Molders' Union and the Amalgamated Association of Iron and Steel Workers which are supposed to explain, if not justify, the stand of the unions in restricting output. One union looks at it from the standpoint of a plain police regulation, intended to save its members from the exaction of taskmasters, and to protect their "health and morals." The other union denies intended hostility to progress and only wishes to prevent an unfair employer from making slaves of his workmen. Inci-

XUM

dentally the real reason is given which shows up the whole subject thoroughly when it is stated that "A labor organization's chief aim is to divide work up so all men may be employed at living wages."

This can only mean that, if it is allowed to prevail, a union may regulate the whole business in such a way that the largest number of men may work the largest time possible irrespective of prices, contracts, good or bad times, etc. And yet the claim is made that progress is not antagonized. The modern tendency of progress is to concentrate work into few hands, in other words to increase the output per man, hence the unions oppose machinery as long as they can. Witness the molding machine question in the foundry and the coal cutter in the mine.

The great trouble with the shop committee is that it applies a different rule for action to the employee than the employer is subjected to. Competition faces the employer, the shop committee acts as it pleases; for instance a job which ran 22 castings per day in an "open" foundry, on reaching a union shop was cut down to 8 by the shop committee. How about a fair day's work here, and where did the owner of the foundry come in? Where the premium plan of piece work is in use, enough experimenting is done to arrive at an equitable basis for paying the employees with due justice to the employer. The union shop committee does not do this, but simply inspects the pattern and then dictates its findings. Take it as one may, the spirit of progress will keep on pushing for a maximum output with a minimum of labor.

## THE MAGNETIC PROPERTIES OF IRON AND STEEL.

Among the interesting reports presented to the American section of the International Society for testing Materials was one on the above subject, your Secretary being a member of the special committee appointed for the investigation. Considerable progress has been made, and in view of the growing importance of steel and iron castings in the electrical field the points under discussion and experiment will be of interest to our foundrymen. The first question is to determine the most accurate method of making permeability and hysteretic tests of magnetic materials. Next comes the per cent. loss in permeability due to scale on iron and steel castings. Then comes the per cent. change in this per-

XUM

meability of iron and steel castings that is brought about by chilling. Then comes the effect of position-in-the-mold on the permeability of cost iron and cast steel. These are matters which have a bearing upon methods of molding, etc., for the castings are made with a view of bringing out these points very strongly, and will naturally show how and how not to prepare a dynamo casting. The other three questions fall into the line of rolled and hammered metal, and do not interest us so greatly. The test castings for cast iron were prepared by your Secretary, and those of steel by the Union Steel Casting Co. of Pittsburg, Pa., all being donated in the interest of science. We expect to be able to record some interesting results in the near future, the work being well in hand at the present writing.

In further explanation, the magnetic permeability of a casting is its conducting power for the lines of magnetic force. Hyterisis is the lagging behind and consequent impairment of the magnetization incident to changes in this magnetic force.

## CASTINGS AT THE PARIS EXPOSITION.

*The Iron and Coal Trade Review,* Sept. 28th. The exhibits of steel and iron castings, while very fine indeed in the French section, were not as extensive and instructive as those of 1878 and 1889. Nevertheless the general impression made is that the art, at least so far as steel castings are concerned, has advanced very strikingly of recent years. The Villerupt Works have a large pyramid of pipes from 1 to 10 feet diameter. About 100 tons of pipes are produced daily in this works, all of them fitted with screw threads on the Jacquemart system. The Pont-a-Mousson Works make 100,000 tons of castings yearly, mostly pipes, have five blast furnaces which keep their eight cupolas going, employ 2,393 men, who receive 662,000 dollars annually in wages, and do a yearly business of 2,740,000 dollars. France exported over 50,000 tons of castings last year. Every French steel plant has a steel casting foundry connected with it. The process used may be either the crucible, the baby Bessemer, or the open hearth. Perfectly sound steel castings were exhibited which stood 48,000 lbs. per sq. in. with 35% elongation. The composition was .14 carbon, .34 manganese and .06 silicon.

## A NEW UNION IN THE METAL TRADES.

*The Iron Trade Review*, Oct. 4th, announces the formation of a new organization of employees which may become a factor in the metal trades. It is called the "Machine Trades and Professions Association," and includes pattern makers, molders, blacksmiths, and machinists. Honorary members may include manufacturers, superintendents, draftsmen and chemists.

The platform is the community of interests between employer and employee as opposed to the general antagonism which is the foundation of the present unions. There are to be no strikes, lockouts, nor boycotts. Arbitration is to be everything, and it is hoped that peace and prosperity will result.

The organization is still a local one in Columbus and Cincinnati. The preamble and constitution is given in full and makes interesting reading indeed. The new organization has a working agreement with the Manufacturers' Association of Columbus which is also given in full. The scope and work of the new employees' association will be taken up for discussion by the National Founders' Association and National Metal Trades Association at their respective coming conventions, where it is expected that the arbitration agreement will be extended to other cities and thus be of much mutual benefit.

## LABOR-SAVING MACHINERY.

*The Tradesman*, Oct. 15th. Mr. E. H. Putnam puts the old question of the workingman's opposition to labor-saving machinery in a very interesting form. He agrees that the stereotyped plea that the final effect of this machinery is to cheapen product, increase the chances of employment, etc., is not by any means the whole of the story, but that there is much more under the surface which would appeal to the workingman if he could grasp the stupendous proportions of the whole question. Stop the manufacture of labor-saving machinery to-day only to the extent of one per cent. of the current production, and it would throw millions of men out of employment. So far as the molder is concerned he should welcome the making of a molding machine, as it in turn makes so many more parts of other labor-saving machines which help to enrich the nation. Stop making

XUM

the iron foundry equipment of flasks, patterns, ladles, etc., all of the labor-saving devices, and see what would result.

On the whole, at the present day, there should be no need of defending the labor-saving machine, but, as Mr. Putnam tersely remarks, "He who can read must remember that there are others who have not yet learned the alphabet."

## DEFECTIVE BRASS CASTINGS.

*Eisenzeitung*, September, finds the causes of defective brass work to be pouring too cold, bad mixing, poor molding sand, and finally wet sand. Only the finest grades of molding sand should be used, and this sifted several times through fine meshed sieves. Stale beer, yeast or molasses should only be added if the sand is very lean. Use the fine sand only next to the pattern, and fill up the flask with the coarser material, which will vent better. Ram the dry sand work harder than the green sand, and dust the latter with charcoal or graphite.

Where fixed colors are required the mixture must of course be made accordingly. Where, however, the work is to be galvanized afterwards, the amount of zinc in the mixture can be raised. This will not only cheapen the castings, but will make the metal run easier, of course, at the same time, weaken it. Where the proportion of copper is high a greater fluidity can be obtained by using manganese copper or phosphor bronze in the mixture. Protect the melt with pounded glass, borax or charcoal dust. This will prevent oxidation As soon as fluid enough stir well, add a little tin, skim and pour at once without intermission.

## CONSUMPTION OF IRON.

*The Shareholder*, No. 4. Mr. Geo. H. Hull, president of the American Pig Iron Storage Warrant Co., gives some interesting statistics. We would regard a million tons of pig iron a large stock in this country, and one-tenth of this amount a correspondingly small one. Yet, after all, whether these figures are large or small, would depend entirely upon the demand. People usually look at the supply, and often forget that the demand is an even more important factor.

The consumption of pig iron in the United States doubles

XUM

about every 10 years. It remains the same for 5 or 8 years, and then doubles in the last period of the decade. In 1899 we were consuming about 15 million tons of pig iron annually. Can this vast demand be met without such an increase in price that it will tend to restrict the use of iron to narrower limits? Large stocks tend to depress prices, and small ones to uplift them, nevertheless a stock of one million tons in August, 1898, did not prevent the price from climbing up, because the conditions then prevailing demanded much more. Mr. Hull believes that while ordinarly a stock of one million tons carried by the producers would depress prices, a stock of five times as much, if carried by the investing public, through daily exchange dealings, would not depress prices at all.

## CRUSHED CAST IRON FOR GRINDING.

*Eisenzeitung*, Oct. 18th. Those who have investigated the various crushed metallic products for grinding purposes will know that nothing is superior to burnt saw steel hardened and crushed. In Germany, however, a white cast iron is sold quite extensively, and the method of making it is given herewith. It is necessary to produce a material which upon crushing does not yield too much powder, for this is practically inert for cutting purposes. This means that the size of the pieces to be crushed should not exceed a nut or bean, be not too brittle and be white throughout.

In pouring the stream of melted iron it can be divided into shot by directing against it a strong jet of water, or even compressed air. The size of the shot can be regulated tolerably by varying the direction and intensity of the jet of water or air with respect to the stream of melted iron, which may also be varied in thickness. Another method is to provide a disc of iron in which are cast radial grooves; this is placed directly over the water and rotated. The stream of iron bounds upon the plate and scatters into gloubles which are chilled by the water. By varying the speed of the disc the size of the shot is determined. The ordinary methods of stamping and sorting are used to make the crushed iron marketable. It may be added that only low silicon irons are available for this work.

XUM

## PRESSED STEEL FLASKS.

*Eisenzeitung*, No. 51, describes a patented flask made of wrought iron. From the numerous cuts accompanying the description one can see that they are excellent examples of the blacksmith's art, and the thought comes to us Americans, "why not make them of pressed steel?" It is said that these light handy flasks are rapidly replacing the heavy cast iron ones now in use in Germany, one foundry alone using over 1,000. There are 15,000 now in use, and their lasting qualities and lightness are certain to give them a good footing in the trade. As made over there they would be too expensive for us, but a pressed steel article should be economical enough here.

## COMMERCIAL ORGANIZATION.

*Engineering Magazine*, December. Mr. A. Hamilton Church, a leader in the science of modern manufacturing, discusses the meaning of commercial organization. The development of manufacturing operations has been so rapid that some portions of it are to-day considered relatively backward, this being especially the case with those departments which do not come into active play in the actual production.

Modern manufacturing comprises a great series of separate operations carried out independently and often out of sight of each other, but yet so devised that they are carefully co-ordinated. The advent of the machine tool, with its endless reproductive power, subdivision of labor, greater power, and accuracy, has revolutionized those operations upon which it could be directed, and to-day a leader of an industry need not be a "mechanic" so much as he should be a master in the art of judging human nature. Be a manufacturer ever so progressive, however he is limited to some extent by his surroundings. It is very difficult to make changes and improvements in old establishments; there are vested interests which cannot be revolutionized at once, and the successful reformer undermines rather than carries by assault. The "departmental ogre," as the "Engineering Magazine" well terms it, has to be reckoned with and intelligence, and not strength, must fight it The usual ending is a modernizing of the machinery and nonproductive appliances, and leaving untouched the organization,

XUM

or trying to revive a dying man by putting him on a bicycle instead of first building up his decaying tissues.

Co-ordination is the keynote of modern industry; this is the opposite to running by rule of thumb. Introducing modern appliances does not always save a factory, in fact if not backed up by the introduction of brains, may hasten the end. It is not good policy to jump over the existing system all at once, but to be continually on guard, changing things gradually and constantly reviewing the situation to take care of new factors that may have entered into actual practice.

An administrative scheme should contemplate not only the means of regulating, but also those of recording. Every case has its own solution, and, as Mr. Church puts it, "there is some book-keeping in organization, but there is no organization in book-keeping." The first thing necessary is a good cost system, even if it is rough, so that the material and labor going into any particular job may be known. This is understood by nearly all the important manufacturing concerns of the country. The relation of the "works expense" to the "general establishment expense," however, is something which but few of even our best firms have really systematized. The expenditures on the productive department and on the selling organization are of fundamental importance not fully realized by the book-keeping mind as yet. The last thing in the analysis of "costs" is the correct discrimination between the different classes of work when in the same shop. This is a very difficult but important matter.

The master's eye and brain in the daily conduct of a small business must of necessity be replaced by the results of statistical work in the large organizations. These results must be capable of quick analysis and application for readjusting conflicting conditions. How many concerns languish after their founder withdraws simply because he cannot transfer the many details of organization from his memory to his successor. These details are essential and must be supplied anew, otherwise failure results. Labor saving devices in the office keep the number of clerks down to normal proportions, yet there is much difficulty in finding good ones for even these jobs. Cheap men will not do, as everyone with experience knows, yet there is much work which can be done by cheap men supplied with comptometer, slide rule, and card systems.

XUM

The most costly thing about a factory is an incomplete organization, and yet much hesitation is experienced before the expense of a good organization is incurred. An additional clerk shows up at once on the pay-roll, but mistakes which occur in the shop because that clerk is not there to look after such and such accounts are smothered up or do not appear. The result is diminished profits. Competition is making it more and more necessary to have quick means to get at the bottom of cost accounts, the margin of waste is also becoming closer, and everything about the works should be arranged to lead toward profits. The place to spend money and time is before the work is begun—this will mean maximum production and smooth working.

No system is complete which does not show up daily results, that does not provide for the progress of every piece of work in advance, and that does not show cost details which discriminate between (a) individual shop expenditure incident with indirect office and sales expenditures; (b) incidence of shop expenditure between several shops, and (c) between different classes of work in the same shop. This means monthly balance sheets and present value of assets once a month at least. It amounts to a continuous stock taking and a continuous audit—a great advantage. Where orders have an individuality the cost accounts must also go into great detail, so that the net profit of a particular job may be found readily. In fact every item of profit as well as every item of loss, should be traceable by the management, and no covering up allowed. Mr. Church concludes with the advice, "Don't be afraid of system"—advice which those who have been through the mill know to be excellent.

## MACHINE MOLDING AND THE UNION.

*The Moulders' Journal*, October. This article is in the nature of a discussion on Mr. Mumford's paper on the molding machine. Objection is raised to calling the common matchboard a molding machine, though it is freely granted to be one of the steps in its development. The spirit which has antnagonized and obstructed the introduction of the molding machine is deplored and ascribed to the inherent nature of mankind which does not want to go beyond the point reached by the generation before. Nothing can withstand progress, however, and so the Union has

recognized the molding machine as one of the factors of shop economy, even if ten years late. This opposition of the union really helped the development of the machine from its primative form to the various specializations now so successfully carried out. The author of the article objects to the statement that unskilled laborers can work the machine properly, holding that once a man has acquired the necessary knowledge to run the particular work well he is no longer unskilled. The argument that the molder will not work as hard as a laborer is also dismissed as faulty, as many a floor requires as strong a back as the machine. The hitch, however, comes in when the question that follows is propounded: "Will the molder bring out the best possibilities of the machine?" The laborer who is accustomed to draw a low pay will be well satisfied with a moderate increase, hence the incentive to the molder should be to offset this by giving a greater product, and thus show that the cheap man is by no means the best. This means the abandonment of old standards of work and a fair test of the new line of output. Now as claims for output are always put rather high by the salesmen it is argued that the molder has no fair show in the game anyhow, for a high output can always be made on a spurt by specially trained men. The spirit of limiting the output on general principles is decried and the "control" by the union scouted as dangerous to foundrymen, all of which one is glad to see in print, but wishes to see carried out in practice too. Probably the trouble is that the progressive spirit now manifested in the molding machine question by the Iron Molders' Union is not fully entered into by local unions as yet, and hence the output of machines run by union men often leaves much to be desired.

It is frankly stated that the policy of the union is to obtain control of the men operating molding machines, not to restrict their output, but to protect them in the matter of wage reductions always affecting unorganized men. The output is not to be restricted, but where the necessity arises the men are to be protected from the evils of overwork. This it is claimed will be commended by all right thinking foundrymen, and thus by a mutual understanding the highest development in the foundry is to be promoted and the best possibilities of the machine brought out.

XUM

## MAKING PIPES WITHOUT A PATTERN.

*Iron Moulder' Journal*, November. Mr. Thos. A. Haigh describes a simple method of molding special pipes without patterns.

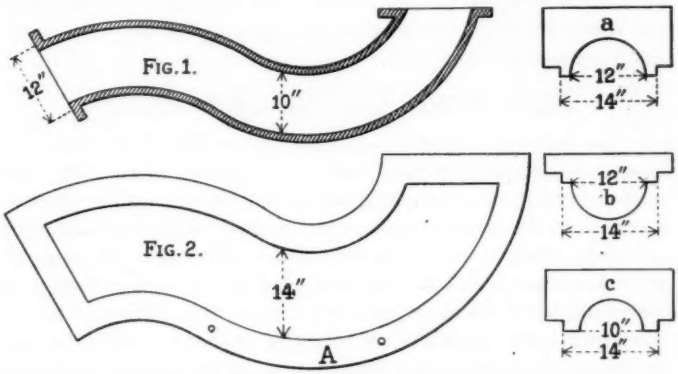



Fig. 1 shows such a pipe in section. A template is necessary to furnish the exact curve and position of the flanges. The sweep board, Fig. 2, and the sweeps a and b are also necessary. A level bed is prepared and the sweep board is placed in position, two round pegs about 10 inches long being driven flush with its surface through two holes about one-third of the length of the board from each end. The flanges—core prints attached—are now taken and bedded correctly in the floor. Sand is now rammed up within the sweep board and the sweep "a" is used to make what will be a sand counterpart of the body of the pipe. The shoulder on sweep "a" is the same depth as the thickness of the sweep board, so the lowest point will work on what will be ultimately the joint of the mold. The pull should be made toward the side A, the pegs not only being a guide in setting the sweep board after the cope is lifted, but also to hold it in place when the sweeps are in use. Remove the sweep board without disturbing the pegs and place the other two halves of the flanges and core prints in position. A level joint is now made and the sand pattern covered with wet parting sand. Ram up and lift off the cope, place the sweep board again in position and dig out the sand between the flanges. Now use sweep "b" and with care and patience the bottom half of the mold will be completed. Remove sweep board, withdraw

XUM

flanges and prints and finish up the mold. The same board and sweep can be used for the cope side if desired, or else cut out a piece of board to half the diameter and finish up the rough places.

To make the core the same sweep board can be used with extensions attached for the prints. This means another sweep as per sketch "c." Dimensions are given for a pipe 12 inches inside diameter and 10 inch bore.

## PIECE WORK AND COST REDUCTION.

*Engineering Magazine.* November. Mr. M. Cokely discusses the question of piece work as an agency in machine shop cost reduction. As the conditions of the foundry are very nearly identical to the machine shop, so far as piece work is concerned, it will repay one to look into the matter. The question of greatest interest between employer and employee is always that of remuneration, for here harmony in values is most difficult. All the world wishes to get all it can, yet labor unions say no to this, and refuse to allow their members to earn larger wages if obtained by piece work. Piece work, by exciting ambition in the workman, is production of a larger output per day, hence, leaving envy out of consideration, the only reason for hostility to piece work on the part of workingmen is the desire to do as little as possible for the highest pay. In this not only the laws of trade and commerce, supply and demand, but the fundamental principles of manufacturing are violated. The result will always be failure even if the struggle is very costly at the time, as in the engineers' strike in England.

The stock argument that by increasing the productive capacity of the workman throws others out of employment is the old one against all labor saving machinery, and has been exploded long ago. A certain amount of production is necessary to maintain existence, and this varies with the increasing population and the advancement of civilization. As wants are increased methods of production must be improved, otherwise civilization will stop. Avarice and ambition in man furnish this improvement, and the time will come when all labor will be paid according to its productive capacity. This is the theoretically just method of remuneration anyway. It will mean the survival of the fittest. It does not follow that the weak should be left to suffer, and certainly not that restraint of the fittest should be provided for their care.

XUM

It is right that men should unite against oppression and degradation, but piece work properly laid out does not produce such an effect, and if any country shows this, America is that one. Honors and wealth have come to those who have used their efforts in well directed ways. Suppose the Iron Molders' Union had never opposed the molding machine, or Machinists' Union had given their members to understand that sitting on a three-legged stool for hours watching a planer do its work automatically was doing their full share of work, would there then have been so loud a call for piece work on the part of those who foot the pay-roll? So long as human nature is as we find it there must be systems of reward and punishment, if results are wanted. Plain old-fashioned piece-work is in successful operation in hundreds of factories. The principal objection against it is the plain way in which wages are regulated, a direct cut being made when the workman is supposed to earn too much. On the other hand what system is there in which this does not take place when improvements in machinery, etc., have made the production higher per man? Cases are known where men have voluntarily asked the piece price to be reduced where they knew that too small a price would be promptly corrected once the matter had been properly shown up. So after all it comes to the men behind the system and that confidence between master and man so desirable to have in existence in every shop.

One of the troubles of many a shop—or foundry for that matter—is long range management. Petty officials who know nothing about the shop practice have the question of remuneration in their hands and exhibit the greatest contempt for men in overalls. In such a case we find every man making just a day's wages, for they all know once this is overstepped too much, a cut is sure to follow, and pity for the weakest man keeps the good ones back as much as possible. If those in charge would let the really good men earn really good wages there would be much less trouble with piece work; as it is we have practically what the unions ask—a uniform day rate.

Another point is the incivility of those who deal with the workingman direct. How often are men defrauded on the slightest technicality and wages are earned under the most trying circumstances. On the other hand employers have to submit to all kinds of burdens through fear of strikes, and a glance throughout

XUM

the shop will show this at once. Speed and feed of machines are the slowest, and the men move like snails. Men who want a day off simply take it. Employers who tolerate this really spoil their help and sooner or later competition will make them change this. Jealousy among the higher officials, with consequent factions and strife, often spoil a good shop. This usually comes from unwarranted interference, and should be promptly settled in the office. "There is no place on earth where the ability to mind one's own business is more desirable than in the organization of a modern factory."

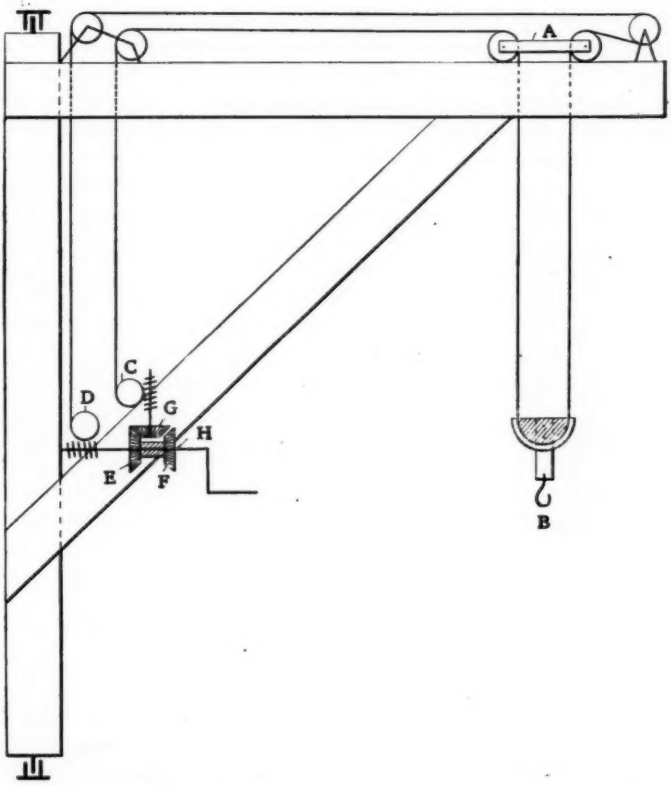
Workmen are, to some extent, what their employers make them. Injustice, bad example and weak management are responsible for much of the enmity between capital and labor, and it is the duty of capital to enlighten labor to remove this feeling. The solution of the labor problem is simply an education by which a knowledge of and respect for the rights of other men is obtained. Clear lines of justice and straightforward dealings are the principles that should be followed in managing help. If this course fails, fight to the finish. The high wages, the short hours of the American workingman are not the result of organization only, by any means; they are the consequence of the active mind, the big day's work and the inventive power of the American mechanic. To-day we are supreme in the commercial world in consequence of years of this progressive attitude.

## A FOUNDRY CRANE.

*American Machinist*, Oct. 25th. Mr. H. Bollincx, the well known Belgian ironmaster, sends the American Machinist a sketch of a small foundry crane which he has not patented and wishes any one to use who desire to do so. The trolley A can be traversed on the crane in the usual way. The cable which carries the load B is placed on the trolley and is coiled about the drums D and C, commanded by the endless screws, which may both turn in the same direction or act in different directions at the same time by means of the gears E, F, G. The double gear E F made in one piece, slipped on the crank shaft and secured by the wedge H allows both endless screws to turn at the same speed.

When, therefore, the two drums wind up the cable at the same time the load is raised. If, however, one drum winds up the

load and the other unwinds it, the load remains at the same height, but the trolley is moved. As the segment does not turn (B) the cable may either be fixed to it or may merely pass under it.




A FOUNDRY CRANE.

## SPECIFICATIONS FOR MALLEABLE CASTINGS.

Mr. E. H. Walker, of the J. I. Case Threshing Machine Co., Racine, Wis., sends us some more of this company's excellent specifications. The castings purchased under the specifications must be of good quality, perfectly annealed, cleaned and free from physical defects such as blow holes, cracks, excessive shrinkage,

misplaced cores, etc. All parts to be fitted must be free from burnt-on scale and sand. Castings which cannot be straightened by "dropping" will be rejected. Physical tests; tensile strength 35-50,000 lbs. per sq. in.; elongation in 4 inch, not less than 1.5%. Transverse test; a round bar, .8 inch diameter on supports, 12 inch apart shall show 1,750 to 2,400 lbs., and deflect not less than 0.31 inch. Drop test: A similar bar on supports 12 inch apart must not break under less than 1,650 inch pounds, the drop being 22 lbs. and the first distance fallen 3 inches, the second 4 inches, and so on until rupture. Torisional test: this should show the malleable iron to have an angle of deflection proportionate between cast iron and wrought iron and should approximate the tensile strength closely. Bending test: pieces from 3-16 to 9-16 inch thick and 1 to 3 inches wide should bend over on themselves around a circle at the bend equal in diameter to twice the thickness of the piece and back again without breaking. (This is the most difficult test and one very hard to meet in the heavier sections.) Specifications are given for the number and disposition of the test bars required. The anneal is specified at not less than 72 hours for the light and 120 hours for the heavy work under the most favorable conditions. The specifications conclude with a page of useful information concerning the chemical characteristics of malleable castings. It will be noted that there are no chemical limits specified, for in malleable castings these are so sensitive that the physical tests would immediately show up any errors of judgment in this direction.

## FOUNDRY COKE.

*The Iron Trade Review*, Dec. 6th, gives an article by Mr. W. J. May on this subject as published by the London Mechanical World. One cause for trouble with foundry coke is the poor cupola and cupola practice met with everywhere, almost anything being satisfactory as long as it will melt at all. The coke should be as free from sulphur as possible, and be close grained and hard. It need not be silvery, as much of the washed coal carbonized by modern by-product processes looks quite dull, but is very good. The coke used for foundry purposes should not be brittle. Soft coke is also bad for a good "bed." Gas coke is worthless for melting iron, but will do for brass melting purposes. Gas carbon, if cheap enough, is economical to mix with the fuel, but care

XUM

should be taken, as it is rather "lively," and burns on the platform are frequent. The experience of Mr. May on melting is as follows: High carbon steels melted in the cupola ran 1 to 3½, charges of half scrap and half pig iron 1 to 10, and occasionally 1 to 11. (This is very likely what Mr. May meant, though the figures actually given bring 1 to 21 and occasionally 1 to 25. In fact he states, further on, that one should be well satisfied with a run of 1 to 14; all of which shows that his figures 107.90 and 160 lbs. coke per 2,240 lbs. iron should read 207.90 and 260 lbs. coke.) The advice is given that no coke under 3 inches in diameter should be accepted.

## THE SIZE OF TIN PLATE ROLLS.

*Tin and Terne*, Nov. 1st. Our old friend, "Fer Blanc," reviews the use of chilled iron rolls in the manufacture of tin plate. Until the time of making tin plate in this country the Welsh manufacturers had not exceeded 16 and 18 inch diameter for their rolls. We began at once with larger diameters, and now use 26 inches more than any other. The advantage of a large diameter is that a larger heat radiating surface is offered, the heating and cooling of the roll is slower, hence more even, and the wear allowed is greater, which means more output per roll. The limit in size will be reached only when the disadvantages of increasing are equal to the advantages, and this has not yet been found out in practice. It has been found that in passing a pack through a 26 inch roll more heat is lost than would be the case in a 24 inch roll. This is a disadvantage which, however, may be made up by increasing the speed of the rolls to some extent, this also reducing the time the pack is losing heat to the air. On the other hand the difficulty of handling is increased, and so the advantages and disadvantages run counter to each other, and experience alone will point out the proper selection. With the tremendous output we are making the founder is naturally looking for heavier rolls all the time, for these can wear longer proportionately and thus save him from guarantees on the smaller sizes which are becoming more exacting as the time passes on.

## FEEDERS.

*Tin and Terne*, Nov. 1. Mr. E. H. Putnam discusses this question from a very practical standpoint. The ordinary way to

explain the use of feeders is to liken the action taking place to the tapping of a column of water of a given height. Unfortunately, however, water does not freeze quite so quickly as molten iron, and hence it is important to not only have the feeder of sufficient height, but it must also be big enough in diameter to insure fluidity until the casting has set properly. This is seen in casting rolls vertically. The pattern is always made longer so that a good head is left for the metal to feed the interior of the roll as it slowly shrinks and sets. When a feeder is pumped properly a smaller diameter will do, as the agitation of the metal prevents it from setting so long as fresh iron is continually poured in. Again the branch gate between feeder and pattern should be as short as possible so that it may not set too quick and thus destroy the usefulness of the feeder altogether.

## THE CUPOLA BOTTOM.

*The Tradesman*, Sept. 1. Mr. E. H. Putnam writes of the annoyances often happening in a foundry through faulty bottoms and their consequent leakage of molten iron. The ground under the supporting post may yield sufficiently to cause trouble; the result will be a break in the continuity of the bed, a leaking out of the loose sand and the giving way of the vitrified surface above. If the bottom is too wet, boiling will ensue, hence it is well to use only sand coming from the dump under the bottom of the cupola, as this is coarse and porous even when snugly rammed. Any holes in the iron bottom should be covered by an iron plate and some stiff clay before putting on the sand. The clay between the bricks of the lining often crumbles out and iron is sure to find a way to get out unless the cupola tender takes great care. Care in tapping should be exercised so that the vitrified surface of the bottom be not broken. These points well observed, together with a good foundation for the supporting post, should prevent any trouble in this part of the cupola.

## SCRAP.

*The Tradesman*, Nov. 15th. Under this caption Mr. E. H. Putnam recites an experience he once had when scrap rolls were mixed with soft pig iron. It seems that the regular run of castings suddenly became too hard to machine properly, and investi-

gation showed that some scrap soft rolls had caused the trouble. Were it not stated that these rolls came from a soft iron mixture, the presumption would be that in spite of their dark, rich fracture they had low silicon; but the trouble in this case seems to have been that the surface of the iron at least was badly burned iron. Stopping the use of the rolls corrected the trouble at once. Of all things to make hard unsatisfactory castings burnt iron is the worst, hence too great care cannot be taken to weed it out, and all scrap which comes under the "burnt iron category" should be kept out of charges intended for "machined" castings.

## THE FOUNDRY REVIVAL.

*The Iron Trade Review*, Nov. 15th. Our Association owes its best thanks to the management of this journal for the excellent editorial in which the needs of the foundry of to-day and our Association in particular are fully discussed. After stating the objects of the American Foundrymens' Association and its relation to the foundry trade, together with particulars as to the annual convention, attention is called to the disinterested and timely work being done to enable cast iron to hold its own against the encroachments of the steel casting industry. When it is remembered that European foundrymen are taking advantage of every point gained by us as fast as they can, surely our people in this trade should support a movement intended solely to benefit them.

*The Tradesman*, Dec. 1st, also should come in for our hearty thanks. The same encouraging words are to be found here, and the good wishes of so many foundrymen are with us too. The function of the Association, in bringing together prominent foundrymen of widely separated parts of the world, for the interchange of thought and experience, cannot be overestimated. The information disseminated is of a very valuable kind, and if foundry progress keeps on at the rate it has since the first convention, the future should look bright indeed.

## MOLDING SAND.

We are indebted to Mr. E. H. Walker, foundry manager of the J. I. Case Threshing Machine Co., of Racine, Wis., for a very interesting set of specifications on molding sands. As foundry

sands are so seldom specified, and this paper contains some very valuable information, the following is extracted. All sands must be reasonably free from stones, dirt, silt, roots, etc. Silica or fire sand, molding sand and core sand come under these specifications. The fineness is specified as coming under 5 heads: superfine, fine, medium, coarse, extra coarse. The degrees of fineness are also given in percentages and the methods to obtain them explained.

Fire sand should run 98% in silica and contain very little lime, alumina, magnesia, and combined water. Fire sand containing more than 1% lime, 4% alumina, and less than 95% silica will be rejected. This is very liberal.

Molding sand cannot be bought on chemical specifications, but certain limits are interposed just the same. Carbonate of lime must not exceed 1.50% for iron molding, and 2.25% for brass molding, iron similarly 5.50% and 7%. Organic matter must not exceed 1%. Sand running over 13% alumina will be rejected, as silt and clay are objectionable. The silica in molding sand runs about 75 to 85%, alumina 5 to 13%, lime below 2.50%, iron below 5%, and alkalies about 0.75%. Combined water is seldom above 4%. Core sand should be high in silica and low in alumina. Low alumina and iron are especially desirable as they permit the rapid escape of gases; they should not run above 5% and 2.50% respectively. The specifications conclude with some notes on the properties good and bad of the various ingredients of foundry sands.

## ARBITRATION MOVEMENTS.

*The Iron Trade Review*, Dec. 27th. A conference of associations of manufacturers and labor representatives was recently held in Chicago, under the auspices of the National Civic Federation. The papers read all favored arbitration of labor troubles in such a way that conflicts may be prevented, and strikes and lockouts pending arbitration are abandoned. Compulsory arbitration as legalized in New Zealand was explained by Mr. Hugh H. Lusk, ex-member of parliament of New Zealand, who took issue with Mr. Samuel Gompers, president of the American Federation of Labor, on the right of any one association of men to disregard the rights of all other men. This, Mr. Lusk said, is not liberty, but license. We have, therefore, not yet reached the stage of New Zealand's development, but were still in the Gomper's stage of the game.

XUM

The outcome of the conference was an address to the American people, reported by a committee made up of six representatives of great manufacturing and industrial interests, and six representative labor leaders of high standing. After stating in general terms the reasons for the conference, and the needs of capital and labor, the following recommendations are made: First, That employers and wage earners should enter into annual or semi-annual agreements or contracts. Second, That all industries should establish boards of conciliation to finally adjust all disputes which are not readily adjusted between the immediate interests involved. Third, That a committee of six representatives of the employer class and six representatives of the employee class constitute a committee to formulate some plan of action looking to the establishment of a general system of conciliation that will promote industrial peace.

## ACCIDENTS TO WORKMEN.

*The Iron Age*, Dec. 20th. An important manufacturing establishment has recently put into operation a method of dealing with accidents which commends itself as very humane and at the same time politic. It is seldom the case that a competent physician can be retained for constant attendance, for accidents are not that frequent, and the community interests here differ very greatly from the isolated mining settlements where the presence of a medical man is imperative. The most usual forms of accidents are fainting from heat or inhaling gas, injuries attending falls, crushed hands and feet from moving machinery and falling masses, cuts from edged tools, burns, heat prostrations, and injuries to the eyes from sparks or metal chips.

In the particular manufacturing establishment in question an emergency corps of 20 intelligent young men was formed for first aid to the injured. The Red Cross manual was given to each for study. A room was set apart, and stretchers, couches and emergency supplies duly provided. A regular assortment of medicines, surgical appliances, stimulants, etc., was provided, but only for the use of the regular physician, this to avoid the delay in sending to the drug store and thus anticipate what would otherwise be a source of worry. The room thus provided was made sacred to the purpose for which it was appropriated; a key was given to

each member of the corps, and no one else ordinarily allowed in. Next, time was taken to study the manual thoroughly and drills established in the use of the torniquet, in reviving the unconscious, and correcting shock. The idea instilled was solely that of first aid, and not an imitation of the physician's proficiency. Appropriate rewards were given to those who distinguished themselves in this service and the incompetent weeded out and replaced by others. There is to-day still a keen competition for vacancies, a membership in the corps being regarded as a distinction. In fact a large number of those not identified with the corps have formed classes for emergency treatment under the direction of local physicians and backed by the local church associations.

In case of an accident the unfortunate man is at once removed from the scene and treated behind closed doors, thus avoiding the turmoil and panic often created. When the physician comes he is asked to criticise the aid given and thus helps to increase the efficiency of the corps materially. Any member who is negligent or timid is replaced at once, and the result is a magnificent set of men imbued with the importance of their work The mistake of keeping a drug store for minor indispositions was not made, for men do not always know what is wrong with them, and giving out drugs by men not qualified for this purpose might result in mistakes and heavy damages. A broken leg is "a condition and not a theory," and herein the system introduced has paid the company well.

## THE BONUS PLAN.

*The New York Times*, Nov. 20th, has an article anent the paying of a bonus to every non-union man working in Cleveland during the great strike existing there. After briefly reviewing the situation the method used to break the strike comes in for considerable criticism. The point is made that the paying of a bonus can only be a temporary make-shift, as in order to break up unions and prevent their re-formation this payment would have to be continued, thus amounting to a very substantial increase in the wages in the trade. Rather than do this permanently employers would prefer to put up with occasional embarrassments brought on by strikes, for if all the industries were confronted with the same difficulty the burden would be too heavy to carry; this from the economical standpoint.

XUM

Men selling their right to do something which might be an advantage to them is an act against public policy; the offer and the acceptance of what is practically a bribe is not highly moral. On the other hand the National Founders' Association has to deal with a condition and not a theory, and this act is looked upon as a war measure. So long as it does not drift into the dangerous principle of the end justifying the means it may not amount to anything serious, but all men interested in the public welfare will welcome a better means of solving this vexed condition of affairs in the acknowledged storm center of the foundry trade. The editorial now discusses trade unionism, holding that without these combinations the individual might have a hard time in the labor market with only the law of supply and demand to fall back upon. The abuses of the unions are admitted, in fact anyone who has built houses and has had the temerity to request the walking delegate to look at the outside of the front door, can testify to this with some feeling. When, however, the unions are managed by able and just minded men, when obligations are respected and agreements kept, when strikes "to show power" cease, and reason guides the actions of these institutions, then they will be valuable to the community. It is a better public policy to help the new spirit which seems to have finally come into the councils of the great labor unions, possibly induced by the presence of great manufacturers' associations, than to attempt to kill each other by arbitrary measures.

## INCREASED COST IN THE FOUNDRY.

*The Tradesman*, Dec. 15th. Mr. E. H. Putnam strikes a responsive chord in the breast of our foundrymen when he discusses the question of increasing foundry costs. In spite of the lower cost of iron, the improvements made in foundry practice, the cost on many classes of work will keep on going up. The solution is to be found in many items. Thus castings are now made much lighter than formerly, the proportioning of the work being more scientific. Drilling is superseded by cores as much as possible. Take, for instance, agricultural machinery; the heavy cumbersome castings have given way to the light, properly proportioned work our farmers in the west can afford to throw away after one season's work. All this means a higher molding cost per pound,

and, therefore, necessarily higher general expenses, handling facilities having to be provided for so many more pieces for the same weight. The man who took a shop in northern Illinois on a contract of $10.00 a ton for all labor and molding and made money on it 20 years ago could not do this to-day, the work being agricultural machinery.

What this increased cost would have been had not foundry management been made a fine art by progressive men, who thus helped the whole industry, would be hard to say. Bad heats are now also rare exceptions in well conducted foundries having competent foremen.

## THE RIGHT TO DISCHARGE.

*The Iron Age*, Dec. 27th. In an editorial devoted to some of the recent phases of the labor problem, attention is called to the effort being made by labor organizations to shape legislation in their favor. Thus, an act was passed in Illinois in 1893 which was designed to protect employees from discharge in case they joined unions. This law was enforced recently on complaint of a carpenter who was discharged after joining the local union. The Supreme Court, in reviewing the case, declared the law in point unconstitutional in that no one could be deprived of any of the attributes which are essential to his personal rights.

It is claimed by labor leaders that any man can quit his work or strike at any moment he pleases. This is conceded as the man's right. On the other hand the employer, as a consequence, has the good right to dispense with the workman's services at any moment he pleases. The editorial concludes with the prediction that in the course of time it is possible that the interests of labor will be adjudicated sufficiently to clearly define the limit to which law making may go before drifts into the unconstitutional variety known as "class legislation."

## HARDNESS, OR WORKABILITY OF METALS.

Mr. W. K. Keep, of Detroit, Mich., a member of our Association, contributed a paper on the title subject as part of the work of the special committee of the A. S. M. E. on testing methods. After reviewing the methods formerly used to determine the hardness of a metal he describes the specially arranged drill press of

Mr. Chas. A. Bauer, which has been in successful use several years. Mr. Keep added an autographic attachment which records the information as a diagram. The drill is so arranged that the working parts are under the table, and the drill therefore penetrates the under side of the test bar, the hot chips then drop and cannot draw the temper of the drill so readily. Various conditions were found to affect the results very materially. They were overcome in an ingenious way so that the machine in itself may be said to be very accurate and effective. Whether, however, the results can be used for comparisons of the various kinds of metals rather than a checking of daily records for the same class of output in a given plant, would need, it seems, a little further study. The recommendation is made that as a pig iron can be tested for hardness 15 minutes before a car is unloaded, possibly pig iron could be sold on a guaranteed hardness. This would seem to run counter to the generally understood characteristics of cast iron, for it is quite possible to make a pig iron unduly soft or hard artificially, the remelt only showing the true nature of the iron.

Mr. Keep gives a very interesting diagnosis of the drill troubles and the remedies which overcame them. The diagram giving the curves obtained with the machine shows that the apparatus is very sensitive to changes in the iron, hard spots as well as soft showing up readily. It is perhaps this fact that the state of the carbons in a casting is not uniform that has made hardness tests of such doubtful value. On the other hand one of the diagrams shows a beautiful straight line, making one wish for such an iron to send to the machine shop. An elaborate series of hardness tests follows, in which composition and shrinkage records are included.

The paper was discussed by Messrs. Bacon and Thos. D. West. The Iron Trade Review, Dec. 27th. Mr. Bacon does not think the test a good one, as the bulk of the work was done in the interior or softer iron, whereas in actual machining nearly everything is surface work, Mr. West objects to the application of the hardness test to pig irons,, holding that no test short of the chemical will show what a pig iron really is. The fact that now over one-hali of our foundries are buying their iron on chemical specifications amply confirms this. To show how easy it is to be mislead by hardness tests in judging pig iron for foundry use, Mr. West exhibits two samples, one of which is hard and the other soft; both, however, on remelting giving soft castings identical in this respect for equal thicknesses and rates of cooling.

XUM

## SILICON AND SULPHUR, AND THE CARBON OF CAST IRON.

*American Institute of Mining Engineers* Prof. Henry M. Howe, of Columbia University, has studied the above subject thoroughly, and gives his results after analyzing all the evidence presented up to this date. The generally accepted theory that silicon lowers the solvent power for carbon at and somewhat above the freezing point (making graphite at the point of set) having been strongly combatted of late, Prof. Howe went to great trouble to examine the evidence, and has arrived at different results than evidently intended by the opponents of the time-honored view of the case. Mr. Bachman's tables in particular, in which the proportions of graphite at first appear to be nearly independent of the silicon contents, show something altogether different. The silicon theory supposes not that the amout of graphite grows as the silicon does, but that the solvent power of the iron for carbon diminishes as the silicon goes up; that is, that the combined carbon grows less as the silicon grows greater. The total carbon is a variable thing, and necessarily with the combined carbon influenced only by the silicon the grphite will be quite as variable. This is exactly the case in Mr. Bachman's results, for his combined carbon drops progressively from .451 to .242 per cent., as demanded by our silicon theory. His other tables show similar characteristics, modified only by the sulphur contents. In all results so far shown the silicon has rather been in the upper ranges, while its influence is very much more powerful in the lower. Prof. Howe now plots the combined carbon, graphite and total carbon of 700 pig irons in a series of tables arranged with reference to the sulphur contents so that this influence is well brought out at the same time. Pig irons with high percentages of manganese and phosphorus were left out, as the results were intended to be comparative. We are

especially gratified to see a number of results published by members of this Association quoted, notably those of Mr. Keep and your Secretary.

The conclusions Prof Howe arrives at are as follows: (1) In normal and relatively pure commercial pig irons, as the silicon increases the combined carbon progressively decreases; (2) This decrease is rapid at first, especially as the silicon rises from zero to 0.75 per cent., and then slower and slower; (3) This influence of silicon is often maked by that of other variables. No. 2 is original with Prof. Howe. He also mentions that the very strong influence of the very first addition of silicon may be modified here, were results available. In fact most of these results have come from the studies of your Secretary on the melting point of cast iron. It may be added that if Prof. Howe would study the "malleable" and the chill roll industry thoroughly he would get much further information strongly corroborating his conclusions. In fact an entirely new factor would be encountered—the size of the pigs—that is, the cooling rate due to the cross section of the castings made. A thin casting with 1.25 per cent. silicon may not show a trace of graphite when cast hot enough. Your Secretary's experience with over 100,000 tons of pig iron, mostly with low silicon contents, makes him feel that Prof. Howe is exactly correct when he states that with little silicon its effect on the solvent power of iron for carbon is very great, and it is less the higher the silicon contents rises. Perhaps our old-fashioned foundrymen who have always acted intuitively on this point will now feel a sort of satisfaction, and specifications for pig iron may not be burdened with "graphite" requirements.

---

## CHARACTERISTICS OF CAST IRON.

*Sibley Journal of Mechanical Engineering*, Jan., 1901. The foundry trade (and our Association in particular) has been honored by the call extended to our fellowmember, Mr. Thos. D. West, to lecture before the students of Cornell University on the characteristics of the chemical and physical properties of cast iron. The publication of foundry methods and results in the last twenty years has awakened the engineering trades and professions to a realization that the foundry offers a field for the em-

ployment of the best intellect and skill available in this wonderful country of ours. Cast iron is so peculiarly complex a material that its many varieties can only be controlled by the chemical constituents given to the mixture and the ratio of cooling allowed from the molten to the cold state. The lecture consists of an excellent presentation of facts bearing upon the subject, most of which have been presented by Mr. West in other papers familiar to our members, and hence require no extended review here. First the history of cast iron in this country is given. Then comes a clear exposition of the fracture question in pig iron, as contrasted with chemical analysis, for its identification. The variation in the fracture for the same iron when cast into various sections is well exhibited in the cases prepared by your Secretary for the committee on standardizing the testing of cast iron. One of the cases (Series A) containing the set of bars cast by Mr. West was presented by him, on behalf of the committee, to Cornell University, and is now in the museum. The specification of pig iron by analysis is discussed, then follows the effect of variation in cooling upon the carbon in iron, the methods by which this variation is brought about being explained fully. The effect of silicon, sulphur, manganese and phosphorus upon carbon come next, and this introduces the subject of correct analyses of your material. Our standardizing bureau is quoted, and the excellent service it has rendered to the iron laboratories of the world mentioned.

Now come the physical properties of cast iron. The density, elasticity, brittleness, and chilling property come in for extended notice, many interesting points being brought out. Shrinkage and contraction are explained and illustrations given of each of these characteristics. Improperly designed castings, with the accompanying evils of crooked and warped surfaces are next treated, and finally we have a resumé of the known methods of testing cast iron, those of our A. F. A. Committee being explained very fully. The lecture is a most excellent one, and should form a compendium well worthy of preservation.

---

## ARBITRATION AND CONCILIATION IN LABOR DISPUTES.

*By courtesy of President H. M. Hoyt, N. F. A.* President Martin Fox, of the Iron Molders' Union, recently read a paper

at the conference held under the auspices of the National Civic Federation of Chicago, Ill. He reviews the relations of capital and labor with all the attending troubles of which his union has had their share since 1859. Then came the first departure from the usual order of things, in the shape of a manufacturers' organization, that of the stove founders. In 1887 the clash came, which was serious, and lasted until 1891, when the first agreement recognizing voluntary arbitration was entered into. Since then no dispute has arisen which could not be adjusted on the basis of this agreement. As far back as 1876 the Iron Molders Union adopted a resolution favoring arbitration, but could not carry out its provisions owing to the absence of a manufacturers's association to deal with. Mr. Fox deduces the following axioms from his experience in this direction. Employing and employed interest must be organized and recognize the principle that capital and labor have an equal voice in fixing wages and conditions of labor before conciliation and voluntary arbitration can be effected. The more thorough the organization the better the results. Work should always continue pending arbitration. Employers should encourage the growth and extension of unionism so that arbitration may be more successful. Common sense methods should be used to settle disputes in small technical details of the business. Mr. Fox viewed with pleasure the formation of the National Foundrymen's Association and made advances that resulted in the New York agreement. This favors arbitration of trade disputes on broad lines. As the N. F. A. admitted founders of all classes of iron it was difficult to formulate a general agreement which covered each case. As there were members of the N. F. A. who refused recognition of unionism in their shop, and as the I. M. U. considered this as of vital interest to their organization, strained relations soon began to exist, and while the New York agreement is still in operation in other sections, in Cleveland there is a very serious war in which it seems that the principles of arbitration cannot be applied effectively. There are, therefore, two attempts at arbitration in existence; one, the stove industry, which is highly successful; the other, with the N. F. A., which is partially unsuccessful. Unless the last remnant of the former antagonism between capital and labor be removed, we can never hope to see a successful application of peace methods, and only labor and manufacturers'

XUM

associations can accomplish this result. Regarding arbitration itself, trade conditions will seriously affect this. It is impossible to arbitrate with a trust successfully, yet with a number of smaller producers it is comparatively easy. In the former case the Government would have to step in with the necessary machinery. Labor never says "there is nothing to arbitrate," but is always willing to discuss matters. Mr. Fox thinks compulsory arbitration is repugnant to American ideas just now, and it would be difficult to obtain judges who understand enough of the case to render a just decision, the experience of New Zealand to the contrary notwithstanding. State boards of arbitration, as they have no power, are not satisfying; they go too much into partisan politics, and their services are therefore not always desirable. Complete organization only and the broadest and freest application of the principles of civilization and arbitration will be the solution of individual disputes.

---

## COMPOSITION AND STRENGTH OF IRON.

*The Iron Trade Review.* Oct. 25, Nov. 15 and 23. Based upon Prof. H. M. Howe's question on what composition should give the strongest cast iron, and again the greatest strength combined with highest durability, Mr. C. H. Vannier writes as follows: A charge containing 4 per cent. pig iron, 96 per cent. scrap and a little ferromanganese was melted in the cupola and some of it poured into a bar 1 in. square and 13 in. long, the mold having an iron chill block for the bottom. The mixture was one intended for light work requiring a slight chill as, for instance, plow points. This bar, tested transversely with supports 12 inches apart, broke at 4,990 lbs. and was chilled half way through. The total carbon was 3.37 per cent. Two other bars from the same ladle, cast in green sand, went at 4,075 and 3,900 lbs. Three thousand pounds would be considered a very good average strength for cast iron when tested thus. Mr. Vannier calls attention to the fact that from this experiment it is shown that chemical composition of a mixture does not govern the strength of cast iron, and that it can be increased by artificial chilling. He forgets that chilling iron changes its chemical composition radically, so far as the state of the carbon present is concerned. Mr. Vannier also finds that air furnace iron is

more ductile than iron from the same mixture melted in the cupola, the transverse strength always being lower than cupola iron, is due to lower total and combined carbon. Thus with equivalent mixtures cupola metal carried 3.5 per cent. total carbon, and air furnace iron only 3 per cent. This deficiency in carbon makes the air furnace chilled metal softer and tougher than the cupola chilled metal.

Mr. Asa W. Whitney comments on Mr. Vannier's results and questions them in the absence of accurate measurements of the bars themselves. Thus a bar 1.02 by 1.06 in. would give a much different result than one 1x1 in. in cross section. The question of chilling one or more sides of this iron is also touched upon as important in judging transverse tests. Placing a bar chilled on opposite sides so that the depth is in the direction of the lines of chill or quickest cooling, its strength would be 80 to 100 per cent. greater than with the depth across the lines of chill.

Mr. A. E. Outerbridge, Jr., asks whether Mr. Vannier placed the strong bar chilled side up or down. If two bars were cast with one face chilled, and they were tested, one with chilled face up, and the other chilled face down, a very great difference would be seen in their transverse strength. The chilled face up would be under compression, and white iron is known to stand enormous strains under compressive force. Hence Mr. Outerbridge concludes that Mr. Vannier's bar was tested in this manner. He also quotes a test he had made in which the transverse strength of the iron ran 4,200 and its tensile strength 40,116 lbs.—a good record indeed. Mr. Outerbridge argues that the superiority of air furnace iron to cupola metal lies in the lesser degree of oxidation, the former is subjected to, the processes being analogous to open hearth vs. Bessemer steel. Ferromanganese is a great help in removing oxygen and sulphur, and is now pretty generally used in car wheel work. In a foot note Mr. Outerbridge records an experiment made with four bars cast from the same ladle, two of which were chilled on one face ¼ in. deep. The plain bars broke at 3,050 and 3,000 lbs., the bar chilled face down at 2,250, and the bar chilled face up at 3,350 lbs., all bars 1 in. x 1 in. and on 12 in. supports.

Mr. Thos. D. West, in commenting on the above, states that he found different results, and traces the discrepency to the iron itself He finds that the combined carbon in the under

side of the test bar must be at a point which will give the strongest metal in the bar tested, and that with one quality of iron the cope side will do this, while another kind may give it in the drag.

---

## MACHINE MOLDED COUPLERS.

*The Iron Trade Review*, Jan. 3d. Mr. H. Whiting describes the method of molding couplers in use at the works of the Latrobe Steel & Coupler Co., of Melrose Park, Ill. Molding machines of the stripping plate type are used, each set of two machines consisting of one for the cope, the other for the drag. Compressed air is used to draw the patterns and replace them, and the machines have everything below the stripping plates carefully enclosed to keep out the sand. An air pillar crane of one ton capacity handles the heavy cast iron flasks to and from each set of machines. These flasks after cleaning out are stacked up by one of the traveling cranes available in a semi-circle served by the above mentioned jib crane. A boy attaches the air crane hook to the trunnions of the flask and mounts it properly on the stripping plate of the machine. Then he brushes the pattern and plate with oil, sprinkles them with dry sand and lets out the proper amount of facing sand from a hopper placed above. From another chute floor sand is admitted and the mold rammed up. Two men do the ramming, though an air rammer would reduce this labor considerably in cost. The boy strikes off the mold, patterns are drawn by air, the crane places the drag on the floor, cores are set, and the cope properly guided on the drag. Molds are gated together, five knuckle molds and four coupler molds are stacked upon each other and handled as one unit by the traveling crane. The rammers work alternately, first on the cope, then on the drag machine, the boy helper, core setter, and crane man keeping them supplied with work. About 12 stacks of molds can be accommodated by the air crane, though the molds are taken away as fast as made. After pouring and shaking out the flasks are re-transferred to their places, the sand tempered, screened and carried to the chutes by means of conveying machinery, as is the core sand also. The patterns are so designed that detachable blocks and varying core prints will enable six sets to take care of nearly forty styles of couplers.

It is stated that the Latrobe Company paid about 77 cents for each mold before the molding machine was introduced, one $3.00 a day molder and a helper at $1.75, making a maximum of 5 molds a day. This must seem strange to founders who are accustomed to get at least twice this amount regularly from their men per day. However, the molding machine reduced the cost to 10.3 cents per mold, which is very good indeed and a splendid argument for machine molding. Sixty-five molds per day is given as the average of each set of machines for a coupler, and the castings show all the advantages coming from this kind of molding.

## PRODUCTION ENGINEERING.

*Engineering Magazine*, Dec. "The Production Engineer is the latest offspring of an epoch whose marvels are yet too new to be fully understood," is one of the opening sentences of a series of editorials in this journal so fully alive to modern methods and results. The vast changes witnessed in the 19th century are far beyond those which have taken place in the sixty odd centuries which preceded it. Steam, breaking through the restraint of the ages, shattered the old order and gave place to the new. Such a radical revolution of the old order of things must necessarily require a re-arrangement of methods of control and direction. Ability is the same as of old, but it must be equipped with different knowledge.

The factory is a study to-day, its health, disorders, constitution, and remedies calculated to upbuild and maintain; all this is comprehended in the larger science of "Works Management." It is not only well to know all this, but it is becoming an absolute necessity. The *Engineering Magazine* was foremost of all journals to recognize this, and is devoting much space to the explanation of principles and the methods involved. The foundry industry will do well to follow this development closely, for proper economy means wealth.

## REDUCING COST OF MACHINE WORK.

*Cassier's Magazine*, Feb., 1901. Mr. W. D. Forbes looks to the foundry to help reduce the cost of machine work. All indications point to a great increase in the output of our present

XUM

manufacturing plants because in the United States no check is put upon the individual to earn the most money possible. Now we must either change the output of the shop tools considerably to the better, or we must change the tools themselves in this direction. As a matter of fact we get only about 75 per cent. of the output of our present tools, on account of the system employed, and also by reason of the indifference of the men. Allow the men to earn more hard cash and do not attempt to get the work by Utopian ideas which are well enough in their way, but do not accomplish as much as a chance to make an extra good day's wages. At the present time seven-twelfths of the possible output of a tool is thrown away, and in a manufactory this is avoidable, as but few operations cannot be carried out successfully at night. A jobbing shop, of course, cannot do this.

Mr. Forbes thinks the greatest change will come in the tools, but by giving them less to do. We buy enormous masses of steel and iron in which the forms we want are imbedded, and the art of the machinist is to remove the metal we do not want and leave just the finished job. The foundry can save much of this work and we are to-day capable of making castings of ordinary gray iron in which screw threads are almost perfect. What is required is more care in the pattern shop, core room, and foundry, and the result will be that many articles of daily use which are now machined will be shipped just as they leave the foundry.

---

## ANNEALING WHITE CAST IRON.

*Journal of the Franklin Institute*, Sept., 1900. Mr. Chas. James gives his experience with the annealing of low phosphorus (.069) charges of pig iron suitable for "malleable" mixtures. The silicon contents of the mixture ran about 1 per cent., and the heats were 3 to 5 tons, melted preferably in the air furnace. The usual test plugs for malleable were cast in its fracture brought to whiteness by a refining action lasting about ½ hour. The annealing was done in the open furnace under full play of gases and air, this method being found to answer as well as packing in boxes of wrought or cast iron. Castings up to a ton in weight could be thus treated. The time of anneal depended upon the thickness of the casting, ranging from a few hours to a day. The change sought in the conversion of combined carbon to Lede-

bur's temper carbon; that is to say, it is similar to the old "malleable annealing process" so often carried out in exactly the same way when a rush order comes in. It seems that very low silicon and manganese prevent the proper anneal by this method. This is the case, also, in the regular malelable process, where low silicon means burnt iron which simply will not anneal either. Phosphorus is dismissed with a few words as non-essential. In all probability a high phosphorus iron would not have acted as those in question did, otherwise "malleable" people could save themselves much unnecessary time in the annealing process. Manganese also influences the results though not so marked as silicon. There are no physical tests given, hence it is impossible to judge fully the real merits of this certainly very interesting process.

---

## GALVANIZING IRON.

*Eisen-Zeitung*, Jan. 3d. There are two well-known methods of galvanizing iron: Simply dipping it into melted zinc, and the electrolytic process, or practically electroplating with zinc. The ordinary method by dipping into the melted metal has the disadvantage of reducing the strength of the articles thus treated, even rendering very thing materials quite brittle. Then again it is impossible to get a very thin and even coat of zinc on such articles, which is an easy matter with the electrolytic process. The difficulties with the electrolytic process, however, are equally serious, or at least have been until recently. The zinc would become deposited in a spongy mass, and much zinc was lost by a brittle granular deposit which settled in the bottom of the tank.

Several firms have recently brought out some excellent electrolytic work, to judge from the samples submitted, presumably through the use of a chlorine compond in their bath to prevent the formation of spongy zinc. The process is as follows: The articles are cleaned in caustic soda to remove oil and grease. Next they are put in a bath of hydrochloric acid and subjected to an alternating current in order to remove the scale. While in this bath a magnet is used to remove as much of the scale as possible in order to save the acid. Sulphate of zinc is used for the bath. Zinc dust is used for the anode, and illuminating gas or carbonic acid is passed over the work to prevent spongy zinc.

XUM

In this manner it is possible to galvanize large surfaces; even complete vessels which are not too large have been thus coated. For distant shipping points a very thin coat of zinc forms an excellent protection for machine parts.

The expense of such an installation, not including the steam engine, is about $2,500, and this will take care of 765 sq. ft. of surface daily, giving the coat of zinc which weighs about 1 ounce per sq. ft. The cost of galvanizing a ton of sheet iron .15 in. thick would amount to $10.00.

---

## MACHINE MOLDING.

*The Iron Trade Review*, Nov. 8th. Mr. S. L. McCord, of Chicago, discusses the question of machine molding as follows: The type of machine wanted to-day is the one which is best adapted to the individual requirements of the foundry, which will produce the best quality of castings at the least cost, and at the same time place us in the most indenpendent position with respect to labor. The question of molding may be resolved into five operations: getting pattern and match-board together and putting into sand; ramming or compressing the sand; removing the pattern from the sand; placing the mold upon the floor; pouring. The riddling of sand, application of facing, shaking out, etc., incident to this work, is the same whether hand or machine molding is adopted. As the principal reason for introducing the molding machine was the attempted reduction in the cost of the five operations above mentioned, Mr. McCord holds that the machine which effects the greatest aggregate saving in these operations is the best one to adopt. This in contradistinction to those machines which save money on only one or more of the operations mentioned. A machine can be easily devised which will admirably do the sand compressing, another by using patterns attached to metal match plates will cheapen the getting of the work into the sand. Some machine makers consider that the greatest saving is made by ramming the sand automatically and rearrange the other operations to accommodate their machine. Others have combined stripping plates with power ramming. Where the ramming of sand is the chief feature, and in very light or very heavy work this is often the case, this idea is good, but for the ordinary run of work the drawing of the pattern and the small

operations attending this will be found to consume the most time. Thus in the case of molding gear wheels, where it took 35 minutes to make a mold, only 7 minutes were used to ram up, the balance of the time went into drawing the pattern, patching up, etc. This is only to show that a careful study of the conditions of things is necessary before designing molding machinery.

The stripping plate is intended to save most of the time lost as a result of drawing the pattern. This was the basis of the first successful molding machines brought out. Schemes to press sand were next added, and the result was a cumbersome and complicated method which has since proved too top heavy. Many founders have since returned to the simple lines of molding machines with greater net saving in labor and castings. The reason for this is plain. When such an automatic machine is completed and in proper working order it will be usually found that a comparison with hand ramming on the simpler machines finds the latter ahead in net gain, the only advantage of the more elaborate being a greater uniformity in castings. Mr. McCord gives a number of examples of this which are very interesting, and, possibly, known to most of our wide-awake foundrymen. On the other hand it is not intended to condemn these special systems either, for what is not good in one case may be just the thing in another. The stand that Mr. McCord takes is that hand machines can do work as cheaply as power ramming machines, and that the hand ramming stripping plate machine is the best of all. Another argument advanced is the ease with which small hand ramming machines can be moved about, thus doing away with sand conveying systems. Again, the necessity of ramming sand uniformly is combatted as it is attempted in some machines, the molder's skill being better caculated to produce the proper firmness of the mold as required by the casting.

The best men to put on a molding machine are helpers who have some general knowledge of foundry work, and who will do as they are instructed to. For a jobbing shop a machine which allows the pattern to be fitted up quickly when work comes in quantity will quickly pay for itself. Another point is on the quality of sand used. This should be tough and pourous, for in most molding machines the pattern is not lifted out of the sand upwards, but drawn downward with all the chances of a drop. Wherever possible a good mechanical mixer should be used.

XUM

Pneumatic sand rammers also come in for their share of discussion, in fact his new adjunct to foundry operations is going to prove itself invaluable, as it does what all machinery is intended for, the reduction of manual labor for getting out work. Mr. McCord advocates the pouring off of molds by the men who make them, as it gives them a chance to break the monotony of molding all day.

---

*The Iron Trade Review*, Nov. 22d. Mr. E. H. Mumford discusses the paper above abstracted. Attention is called to the fact that here are thousands of machines in daily operation which do nothing but squeezing, and power ramming is but one step further in that the machine does the squeezing instead of the man. Judging from the orders which Mr. Mumford has received, the days of the power machine and the machine without stripping plate are not numbered by any means. A number of examples are quoted and comparative prices given which tend to show that the stripping plate is a pretty expensive thing. On the whole it is well to thoroughly discuss the situation, as the future of the gray iron is in some measure tied up with the problem of molding machinery.

---

## SCRAP METALS IN BRASS FOUNDING.

*American Machinist*, Nov. 1st. Mr. C. Vickers speaks of the use of scrap in the brass foundry. Junk dealers usually separate old brass into the yellow and red varieties, and each of these two classes into heavy and light scrap. The heavy red brass scrap we get is usually made up of machine parts, etc. Light material of this kind generally consists of material which has been rolled. Of the yellow brass varieties we have all rolled pieces, clippings and sheet classed as light yellow,, and all castings classed as heavy yellow brass scrap. Scrap copper in the form of old commutator bars and scrap wire are also used in the brass foundry. White metal, pewter, and alloys of that nature, are frequently used in place of tin by foundries where new metals are considered too expensive.

In sorting a load of purchased red brass scrap, all large pieces are picked out and put into bins, car brasses are kept separate, as they are uncertain in composition and often contain

enough iron to spoil the mixture. The heavy material thus sorted is likely to be hard in nature and should include all wearing parts of machinery found in the lot. Those pieces which are used to resist steam or water pressure will likely be found of a softer nature, and are therefore kept separate. The balance of the fine stuff is shoveled into a special bin.

Now, in making new work, say a good ordinary soft bronze with two-thirds scrap, using a No. 40 crucible, we take two ingots of casting copper or 36 lbs., $2\frac{1}{4}$ lbs. each tin, zinc and lead, and add to the whole 75 lbs. scrap. This makes $117\frac{3}{4}$ lbs., which is all that can be put into the crucible comfortably. The scrap used should consist of 50 lbs. soft red brass and 25 lbs. of the miscellaneous material. If car brasses must be used, let the crap consist of 50 lbs valves, 15 lbs. small scrap, and 10 lbs. brasses added to the new material. These mixtures will keep the castings uniform in color. Yellow brass may be used in place of zinc. In this case use $7\frac{3}{4}$ lbs. of yellow brass for the zinc in above mixture, but reduce the scrap to 70 lbs. and add $\frac{1}{4}$ lb. each to the tin and lead. If pewter is used in place of the tin, or if the tin or pewter is cut in half and the lead doubled, the resulting metal will still be good enough to machine well and be serviceable for small castings. Mr. Vickers suggests that all pewter be examined carefully for silver, iron, and brass, and that it is best melted down separately and run into ingots.

The hard red scrap is used for hard bronze castings in a similar manner as that given above for the softer varieties of work. If there is no special use for this material in the foundry it may be used with advantage to replace tin in the regular mixture. In this case 6 to 8 times the weight of the tin wanted otherwise should be added and the amount of copper in the mixture reduced 5 to 7 lbs., or left as it is and zinc added to take care of the additional amount of copper thus introduced. Where phosphor bronze castings are wanted cheap, melt this hard scrap and add $2\frac{1}{2}$ ounces of phosphorus to every 100 lbs. of scrap just before pouring.

In general a piece of phosphorus $\frac{1}{2}$ inch in length is a good thing to add to every pot of metal, as it deoxidizes it readily. Soda is also a good thing to throw into the mixture while melting, as it cleans the metal.

XUM

## ORGANIZATION AMONG EMPLOYERS.

*The Iron Trade Review*, Nov. 22d. In an editorial attention is called to the recent conventions and meetings of Administrative Boards and Associations for the purpose of extending the conference idea to a wider circle of manufacturers and labor unions. The tendency toward adjustment by association of labor and compensation disputes is becoming more general, and therefore the entire strength of a labor organization will no longer be brought to bear upon a single firm in order to coerce it into compliance with demands. Where the labor leader has to deal with a committee standing for hundreds of works and millions of capital the questions acquire an altogether different aspect. The foundry trade has taken the initiative, and, by the way, through the effort of the American Foundrymen's Association. The present status is that many large labor bodies are asking to make contracts and agreements similar to those arranged by the molders' union and the National Foundrymen's Association. Whether this new movement will amount to anything time alone will tell. If the unions insist on their demand to cut out of work every non-union man, if a certain fixed wage shall be paid to a workman whose only stipulated qualification is that he belongs to the union, and if it shall rest with the union to fix the day's work at a given price, the whole movement will be found artificial and will fall to the ground. It is against economic honesty just as much as a capitalistic combination to control prices and output by sheer force. Such agreements will never have permanency, for the price of the product and labor may not fit when compared with the status of other industries. Any temporizing on the part of capital with labor, based on false economic measures, just for the sake of peace, will fail badly. Educational work must be done to overcome the estrangement between men brought about by designing schemers in either camp. If the spirit of conciliation is carried along with a careful course of study in manufacturing economies, a "more excellent way" is sure to be found for the settlement of the differences that exist.

---

## SHOT IRON.

*The Tradesman*, Jan. 15. The question of utilizing shot iron has brought forth an interesting discussion, and Mr. E. H.

XUM

Putnam takes up one line of argument for dissection. It has been claimed that some of the shot charged in the cupola went through unmelted, or if melted, it was covered by a protecting skin of slag or oxide which prevented it from mixing with the rest of the molten iron. After the castings were made these particles of shot were found embedded in the metal and gave trouble in the machine shop. Mr. Putnam traces the melting of the shot in the cupola and shows that from the nature of things that it was impossible for a globule of melted iron to retain any protecting coating after entering the melted bath. Again, the melting point of shot was practically that of white iron, or, in other words, lower than the bulk of the charge. So much for melting shot. Now for the shot found in castings. This may be of two kinds: the shot scattered in pouring a casting and floating on top of the iron as it passes into the mold (and always found on the cope side), and the shot found in cavities of the casting itself. The first condition is easily understood by any practical founder. The latter, however, may not be so plain. Mr. Putnam attributes it to an oozing out of metal in a cavity formed during set. Herein he is right, for this very phenomenon has been investigated by Prof. Ledebur, the foremost Continental authority on cast iron, who found the globule which had thus oozed to contain very high phosphorus, and was therefore formed by segregation and remained fluid when the rest of the metal was setting. This form of shot is always hard and usually bright, while the other shot formed by the spattering iron, though hard also, is coated with a black oxide of iron.

---

## DEVELOPMENT OF THE MALLEABLE IRON INDUSTRY.

*The Tradesman*, Jan. 1. Mr. E. H. Putnam, the editor of the foundry department in this journal, traces the development of the malleable casting industry from its earliest times, and incidentally discusses the South as a promising field for new undertakings of this kind. The efforts to establish a malleable works in Chattanooga are mentioned and the complete success of this enterprise shows what can be done in this growing section of our country. Mr. Putnam holds that the personal ele-

XUM

ment is the most potent factor in the industrial world. The man makes the business, and while paternalism is decried everywhere, yet this very state of affairs is at the bottom of our whole industrial world to-day. From the early experiments of Seth Boyden in this country to our present annual production of over 500,000 tons of malleable castings a year is a great step, but this is only due to our wonderful talent of developing a good thing, for on the other side of the water malleable castings are to-day dearer than those of steel. There is a gradual change going on from gray iron to malleable for certain classes of work similar to that taking place from gray iron to steel castings, and eventually we will find things settling down to bed rock and each industry taking that only which belongs to it. In the course of his interesting article Mr. Putnam discusses the recent notes on malleable castings which first appeared in the Engineering & Mining Journal (and were reviewed in our journal some time ago), and lays special stress on the South as one of the most promising fields for the further expansion of this most wonderful industry.

## COPPER CASTINGS.

*American Machinist,* Jan. 24th. Mr. C. Vickers gives a number of formulæ for making copper castings. Melted copper has the peculiarity of absorbing gases readily which come out as the metal sets. The result is a spongy mass wihch is perfectly worthless. As a consequence other metals are always added to alloy with it, as for instance, zinc, antimony, tin, and arsenic. Among the many recipes Mr. Vickers gives, those best known as effective are stick phosphorus and silicon bronze. Thus a good mixture for hammers, soldering bits, etc., would be copper 100 lbs., zinc 1½ lbs., stick phosphorus 1½ inches; also silicon copper 1½ to 2 lbs. with 100 lbs. of copper. Mr. Vickers does not recommend aluminum in copper castings. He quotes a number of authorities on the subject of copper castings which may be of interest to those specializing in this line.

## CONSUMPTION OF FOUNDRY IRON IN 1900.

*The Iron Trade Review,* Jan. 31. The pig iron statistics show that between June 30, 1899, and June 30, 1900, the production of this country was close to 15,000,000 tons, and that the

second half of last year fell below the first half by about 1,500,000 tons. While Bessemer pig iron declined over 250,000 tons from the production of 1899, basic pig increased 87,000 tons and foundry and forge irons 340,500 tons. So far as foundry irons are concerned the tables show that in 1898, 3,651,106 gross tons were produced; in 1899, 4,432,892, and in 1900, 4,773,414 tons. The editor of the Iron Trade Review concludes from his studies of the situation that the consumption of foundry iron in 1900 was over that of 1899, and this in turn over that of 1898. The indications are that while prices will be low the year holds good promise for activity in the foundry trade in all lines, and pig iron is being steadily taken on contracts with foundries right along.

---

## ARBITRATION OF LABOR QUESTIONS.

*The Iron Trade Review*, Jan. 31st, gives Mr. W. H. Pfahler's paper, on the title subject, recently read before the Civic Federation Convention at Chicago. The careful student of our country's development in manufacturing cannot but come to the conclusion that the existing war between capital and labor, waged as it is by both parties equally at fault, is the mistake of misguided efforts on the part of both the employe and the employer. And yet there really is no excuse for such a war, as the achievements we are so proud of are certainly due to the combined effort of labor as it is and capital, which is only the accumulated labor of former generations. In the last 60 years many distinct cycles of method have been passed through. These meant so many different relations between capital and labor, and each change seemed to mean an effort of one or both parties to resist it by force. In the earliest times the only manufacturing required by this country was the production of simple articles for food, clothing and shelter, and only as the supply got to be greater than the demand did manufacturing expand by reason of increased trading between shop and farm. The simple conditions then existing required all around mechanics, and under wise laws these mechanics and their apprentices soon built up an industry which was lucrative and most attractive. Soon competition with foreign countries came to be felt, and protection of our growing industries became the order of the day, and demagogues told the

wage earner that the wage payer alone profited by this protection. The result we see to-day in the estrangement of capital and labor. Then came stoppages of all production whenever a dispute was on. Close lines were drawn where no one ever thought of such a thing before. Wealth and comfort increased for both the payer and the earner, and things looked brighter until the new doctrine of equal pay for men without regard for difference in skill and industry was enforced with more vigor than wisdom. The day of the all around mechanic was now passing; machinery, power and the subdivision of the work hastened the end, and soon the labor union motto was "The standard by which labor is measured is the standard of the lowest workman in his branch." As, however, the law of supply and demand is inexorable, the lowering of the standard of men was met with machinery and combination which allowed still further competition, but widened the breach between capital and labor still further. The strike and lockout were the only arguments used, and wild attempts were made to change conditions which came from the disregard of the ways of harmony and cooperation. So so-day we have the employer struggling to increase output and lower cost of production, and the labor union working toward a reduction of the standard of the active workers as well as the number of apprentices. Both really operate against that high standard of citizenship which existed in the early days of our history as a manufacturing nation.

So much for the causes which ave led up to the present condition of affairs; now for the remedy. A prominent labor leader recently stated that only one man in fourteen is a union man, and yet the demand is made that none but union men shall have employment. Surely the right to become a union man also involves the right to remain a non-union man and be a good citizen. This unfair demand of the unions that only union men should be employed brings with it the other condition that it is unfair for employers to discriminate against a union man and his union. Mr. Pfahler holds that these two foolish propositions have kept apart the two sides and prevented movements toward harmony and peace. The right to organize belongs to both parties, and what seems impossible to straighten out by individual effort can be done by organized bodies using "arbitration." To be fully successful arbitration must prevent strikes and lock-

XUM

outs. Work must not cease pending discussion and adjustment of differences, otherwise there results the exhaustion of resources. Things begin to look bright when we find a powerful labor organization seeking the co-operation of the manufacturer, and on the other hand a most powerful association of manufacturers seeking "the adoption of a uniform basis for just and equitable dealings between its members and their employes whereby the interests of both will be properly protected." A conference of both parties can only result in good. Each party will have to abandon untenable demands and a common point reached will insure the expansion of our industries until we supply the markets of the world—our manifest destiny.

---

## AMERICAN FOUNDRY PRACTICE.

*Eisen-Zeitung*, No. 3 compares American foundry practice with the German. "The reason we hear so much of the excellence of American castings is readily seen when we note their excellent surface, graceful proportions, economical distribution of the metal and designs which avoid difficult molding methods. The patterns are much finer, usually made of metal, and are kept in excellent shape. America is the land of specialties, not so Germany. Americans do not hesitate to transport the molding sand best adapted for the work from a great distance. In Europe, on the contrary, it seems essential to use the material of the immediate vicinity no matter if half the molding labor is lost. Again, no bad work is accepted from the American workman, he must moreover bring his own tools, while the company supplies the necessary facilities. American core making is far ahead of the European; apprentices and handy men are not allowed to botch up the work as is the case in Europe, core making being considered a skilled trade here. The whole foundry is filled with modern appliances, and the American tendency is to do everything possible in the foundry which will reduce the subsequent labor to a minimum."

---

## INDUSTRIAL PEACE.

*The Iron Trade Review*, Dec. 20th. Mr. Robt. H. Jeffrey, of the Jeffrey Mfg. Co., recently read a paper before the Engi-

XUM

neers' Club of Columbus, O., which deserves special mention. In these days we can only succeed by seizing upon one peculiar field and pushing this to the utmost. Energies scattered are energies lost. Special training is necessary to keep pace with your companions and competitors. Competition has been the cause of our remarkable development and proficiency in every line of work, and this competition which has combined capital has also bonded together labor. Now, as combination has been the result of the internal struggles of both capital and labor, each in its own sphere, so will it necessarily follow that the combination of capital and labor comes from the necessities of the case. This may seem visionary, but everything points to this conclusion just the same. Mr. Jeffrey describes the quaint and harmonious relations between employer and employe in former times the change wrought by the increase of business and the pursuit of the mighty dollar. The antagonism of capital and labor as it increased brought with it strikes, lockouts, mob rule, intimidation, etc., and capital suddenly found that it could not do with labor as it pleased, and a halt was called in the methods heretofore prevailing in the dealing with men. Reason once more adopted, the natural consequence was organization on the part of the employers, the intention being to compel a fair deal all around. The Founders' National Defense Association, The National Founders' Association, and The National Metal Trades Association are striking examples of what can be accomplished by organized effort. During the period of 1886 to 1894 there were 10,000 strikes, employers lost $52,000,000 and the men $112,000,000 in wages. The greater amount fell upon those least able to bear it. This does not count the loss to the community entailed either.

The remedies suggested are, compulsory arbitration by law, with no strikes or lockouts. If not this, then arbitration agreements, or a voluntary arbitration so arranged that the employer agrees not to resort to a lockout if his employes will not call a strike—all pending arbitration.

---

## GROWTH IN FOUNDRY OPERATION.

*The Iron Trade Review*, Feb. 7th. Mr. A. S. Findley, editor of this journal, writes about the recent statistics on the foun-

dry trade, which show that we now have 4,419 foundries in this country, and that while steel foundries have sprung up very rapidly, gray iron work has not suffered by comparison at all. Cast iron is asserting its vitality in a remarkable way, and this is due in no slight measure to the efforts put forth for more intelligent operation in the foundry, and attainment of greater certainty in results. Be the organizations which handle wage questions ever so important, "those whose object is purely that of advancement on technical lines are proving of incalculable value in their meetings and their literature, and the stimulus they give to the development of the best possibilities of cupola iron."

---

## A FOUNDRY LABORATORY.

*The Iron Age*, Jan. 24th, describes and illustrates the laboratory of the J. I. Case Threshing Machine Co., Racine, Wis. Great stress is laid upon the necessity of a practical application of the results brought out by laboratory investigation. Practical chemistry and good common sense are required as well as harmony between chemist and workman. Not only chemical tests are required, but physical ones as well, and the application of this combination is invaluable to the purchasing as well as the operating departments. In the laboratory in question regular tests are made on steel, wrought iron, cast iron, bearing metals, alloys, wood, coal, coke, oil gas, refractories, foundry sand and facings, leather, cloth, rubber, paper stock, paints, varnish, rope, etc. All hands work in harmony from the president down to the cheapest sampler, the aim being to make the laboratory as useful as possible to the works. An excellent technical library graces one of the rooms, a complete set of samples of pigments are to be found in a large show case, the number running nearly up to 3,000. The chemical laboratory is in a special room fitted with all the necessary appliances, about 16 complete analyses of iron and steel being made daily here. The physical apparatus has a special room also, a number of machines for various purposes being installed there. To the officers of the company belongs the credit of getting up the laboratory to its present state of efficiency, and it will repay those who contemplate establishing laboratories in their works to read the article carefully.

XUM

## TIN SCRAP.

*The Iron Trade Review,* Feb. 7, 1901. Recently the demand for tin clippings has been such that 10 to 12 dollars per ton, f. o. b. cars, is being paid for them, and prices may even go higher. Holland and Germany take all they can get from us. Formerly the price was one-fifth of the present one, and the material was a drug on the market. About 50 or 60 lbs. of tin per ton can be recovered from the clippings, in the shape of an oxide, and this is sold to enameling works. As a rule the clippings are compressed into blocks of one cubic foot each, the weight of these being about one-third of the same bulk of steel. The open hearth furnace recovers nearly all the iron; in the cupola a considerable quantity is lost. Nearly all the material run through the cupola goes into sash weights, a number of foundries in this country making this their specialty. Where much of this material is used it may be treated first in a furnace so constructed that the solder is collected. Then it can be fed into the cupola continuously by a conveyor which dumps it right into the charging door.

---

## BRASS SCRAP.

*American Machinist,* Feb. 7th. Mr. C. Vickers discusses the disposition of scrap made and used by the brass casting trade. Considerable quantities of borings and turnings are made in the finishing shops which must be used up by the founder. First the iron is removed by means of the magnet, as otherwise the iron filings which are held in suspension to some extent will make hard spots in the final castings, which in time means trouble in the machine shop. Grease may be removed by the use of lye or by burning, and then the chips may be boiled in strong alum water. This will remove the very fine particles of iron still remaining in the brass, where the castings are important. For ordinary purposes, however, the magnet is quite sufficient. Sometimes the scrap brass is melted up of an evening and run into ingots by the furance tender, or old worn out crucibles charged with it and let soak over night in a fair fire, to be broken up in the morning and the "heel" of brass extracted.

Spilled metal should always cared for, as the loss is soon noticeable. Sweepings should be screened and the iron removed

the usual way. Even brass dust from the emery wheels should be used up a little at a time, if possible. If in too great a quantity it were best disposed of to the smelter. The hearth and ashes will also stand watching, so also old crucibles which are broken up by tumbling with heavy iron pieces and then sifted for the brass.

---

## PIECE WORK.

*American Machinist*, Feb. 7th. A contributor to this journal gives some points on what is usually considered a burning question in manufacturing. The great prejudice against piece work among mechanics is due to the practice of cuttig prices. A man's ambition to turn out a big day's work is dampened very much if it brings him a cut in his earnings, in other words it looks too much like a break in an agreement. The solution of this difficulty lies in establishing the piece work or premium system on a good basis. As all men differ in their capacity for good output the best men in this case would get the best pay, which is certainly a fair proposition. Nothing makes a man more dissatisfied than to see another workman get the same pay as he does and yet only produce one-half as much work; the consequence naturally is that he ceases to produce as much as he really can do. Now piece work soon fixes this. The man becomes his own boss; if his tools are not what he should get he soon makes a strong kick. He sees that he gets good castings, saves time in every possible way and makes money for himself and incidentally for his employer. Self-interest is a strong incentive to increased production. There is naturally a tendency to slight the work, but this can be quickly eradicated. The inspector, if he should pass defective work, would soon lose his job and his reputation, and the so-called "non-productive" labor would be greatly reduced. As a matter of fact about 50 per cent. of the common labor about a shop can be dispensed with when once piece work is introduced. This has been proved repeatedly. It takes some time to change around from the day to the piece work system, but with the proper man in charge it is readily accomplished, and reduces shop cost very essentially. In an editorial in the same journal exception is taken to some of the above statements. Rate cutting is regarded as inherent to the piece

work system, since competition is a very hard thing to run up against. The premium plan, however, leaves the rate the same and increases the earnings of the men and lowers the shop cost at the same time. Piece work simply does not and cannot fulfil these conditions.

---

## PROGRESS IN AMERICAN FOUNDRY PRACTICE.

*Age of Steel*, Jan. 15th. A paper by Mr. Thos. W. West, in this journal, is of special interest, as it gives a comprehensive review of the progress of twenty years in the foundry. The wonderful advance made in all this time is rightly laid to the vigorous educational campaign in which Mr. West is among the chief exponents, if not the originator. When all the practical molders laughed down the idea that they could learn something from the experience of others, a few bright minds among them persisted in writing their ideas until to-day a revolution in foundry methods is an accomplished fact. Where formerly the molder's skill alone could be counted upon to yield dividends, now there are many other things which help to create shop economies. This is the day of specialities, brought about by the severe competition and the necessity of devoting one's time to one thing. The result is pretty nearly perfection in product and an equipment which leaves little to be desired in shop economy.

In looking over the changes in detail we find that power cranes have replaced the hand system. The electric crane has proven finally to be the best adapted for all around use, the traveling and jib types being preferably in the same shop where heavy work is to be made. Cupola construction has advanced but little, the types in use being very efficient. For large cupolas the "center blast" is to be recommended. We now have electric elevators to lift our iron and coke. Castings are cleaned better, the sand blast, pneumatic chipper, etc., expediting the work very materially. Core compounds have helped to make difficult core work safer. Core and molding sands can now be obtained better mixed and more uniform than formerly, some dealers having introduced facilities to grind and screen their material.

The chief progress, however, has been in the selecting and mixing of iron for foundry use. Fractures are now known to be

deceptive, as the appearance of the broken pig depends upon so many factors. Strange to say, the advance in foundry practice has not brought with it an advance in molding skill. The proportion of skilled men in the industry was greater twenty years ago than now. This age of specializing has taken from the young apprentice the chance to become proficient in all classes of work. If he did not find literature to post him on the principles of his trade, he would be poorly off, indeed, for how could he realize his mistakes except by learning from the failures of others also? Mr. West very properly holds that as a result of all this educational work the foundry has been raised in the estimation of all the mechanical trades, and to-day stands in high respect in scientific and engineering circles.

---

## ARBITRATION IN PRACTICE.

*The Iron Trade Review*, Feb. 7th. Mr. H. W. Hoyt, President of the National Founders' Association, recently made an address before the National Civic Federation conference at Chicago, which is of great interest to our foundrymen. "If voluntary arbitration will tend to solve the industrial problem along the lines of least resistance, how can it best be attained in this country?" is one of the questions suggested for discussion. The line of least resistance is unquestionably voluntary arbitration, and the highest conception of arbitration is that of an unbiased conference board—selected, if possible, from circles outside of the contending parties, or made up of an equal number of both, and an umpire chosen by them. To be satisfactory a settlement should be made without requiring the aid of an umpire. Arbitration means compromise, and unless both parties come prepared to compromise failure will result. The personnel of the board cannot, therefore, be too carefully arranged for. Conferences cannot be troubled with conduct savoring of the lodge room and unionism, neither will it do to ignore the wage earners in their collective capacity. It is to avoid a great industrial calamity certain to come that the conferences are going on. The National Founders' Association is one of the practical results of this evolution of modern social economics. Its objects are the adoption of a uniform bases for just and equitable dealings be-

tween the members and their employes and the investigation and adjustment of questions which may arise between them. Permanent results have already been obtained, and the scheme of arbitration is now being materialized, which means that the local troubles and annoyances are done away with and a much broader view of the situation is taken by men most competent to judge the merits of each case. So long as the wage earner is taught to believe that society wants to rob him of part of his earning power, trouble is ahead, and only after the unions themselves had shown what power they could wield did manufacturers combine for self-protection. Arbitration will not yet lead to the millenium, but the peaceful and enlightened process of conciliation will do much to adjust wages, hours and shop conditions to the satisfaction of the parties of both parts. Let everyone strive to bury prejudice, let them not yield to the temptations begotten by the arrogance of power. No one is infallible, but we do know that arbitration and conciliation have always flourished best in an atmosphere of tolerant discussion, and the only safe line of conduct to follow was long ago called "the Golden Rule."

---

## MODERN FOUNDRY PRACTICE.

*Engineering Magazine*, Jan., 1901. Our fellow member, Mr. Percy Longmuir, of England, has a splendidly illustrated article surveying modern foundry practice. He begins by deploring the backward condition of things usually met with among the "brother smuts," but says there is no complaint of hardship beyond that caused by poor or absent appliances. The general jobbing foundries have undergone but little change, and only in the "specialties" do we find a marked improvement. While the old conditions were very exasperating, to-day there are other troubles for the founder with which he was not confronted formerly. The requirements of to-day are much higher both for iron and steel, and for bronze. Mr. Longmuir now reviews the equipment of the modern foundry in detail, dwelling upon each feature as it comes in rotation, giving our American practice, as taken from the papers read before our Association, and his own experience here. The comparison with English conditions is highly interesting, especially for brass and bronze production.

A series of very fine half-tones, most of which will be recognized by our foundrymen, accompany the running narrative, which covers about 24 pages in all.

---

## INDUSTRIAL ASCENDANCY AND ARBITRATION.

*Engineering Magazine*, Feb. Mr. C. B. Going discusses this question from a very broad standpoint. Men are beginning to learn what "paying" really means, and look beyond their shop door and the end of the working day to see that their men are enabled to keep themselves in shape for a maximum of efficient effort. Advanced manufacturers are more humanitarian than formerly, for they find it pays. The pursuit of economy is the controlling motive of modern life, materially speaking, and as economy is the quickening impulse in all manufacturing progress, so it should be the underlying principle in the adjudication of social and industrial problems. Prevention of waste in material or labor is the foundation upon which modern industry is built. There is little economy in perfecting the economy of the boiler and then wrangling with the fireman about his pay while the plant stands idle. Again, a system which is built to break down at any moment is not what a modern management would tolerate for an instant in a shop—yet this is done with labor, as it is, right along. As a matter of fact, progress has been too rapid to be systematical, and the things seen first have been attended to, the deeper problems seemingly neglected. Only lately have we learned that much more depends upon the organization than upon the equipment of an enterprise. This idea is spreading slowly. The mechanical triumphs of to-day were won against skepticism, and so the idea of a natoinal system of arbitration between employer and employe will win in the end also. Even as war is being discredited politically as fearfully wasteful, so also is commercial war. England lost trade during her prolonged labor struggle which she will never regain, the United States having passed her as an exporting nation. We must, therefore, see that the same trouble will not confront us. The growing movement toward organization built of laborer and employer is furnishing the machhinery to get proper arbitration movements into working order. While it does not follow that

the upholding of a just principle is not perfectly proper, even if it means industrial war, in fact many points now readily conceded were won only after vast expenditure and losses; yet the very experience thus gained should make it impossible to have the matter fought over again. Hence "from lessons of war prepare for peace."

---

## SAMPLING PIG IRON.

*The Foundry*, Feb., 1901. Mr. W. G. Scott, of Racine, Wis., contributes an article on the above subject, from which the following points of interest are reviewed: In order to get good foundry results at all, where chemistry is used, it is, of course, highly important to have the correct analysis of your pig iron pile. The question of proper sampling would naturally come up first. Mr. Scott gives his method. Sampling is done in the car, which, if meeting specifications, is unloaded and piled up in rows about 15 feet long and 5 feet high, the two ends being built up first. This method costs about seven cents per ton, including the unloading. Ten pigs are selected according to the relative proportion of close, open, or medium grain iron on the car, and equal amounts of borings from each taken and well mixed. In case of rejection the car is re-sampled and another analysis made, and the same privilege given the blast furnace selling the iron. Borings should be taken from the portion midway between the edge and the center. About a heaped tablespoon would be the maximum amount necessary for the laboratory. In gray iron work silicon and sulphur are usually necessary only, but it is better to have enough for duplicate and check determinations.

---

## CUPOLA MIXTURES.

*The Foundry*, Feb., 1901. Mr. W. S. Scott gives his method of calculating cupola mixtures. Suppose we have 3,000 lbs. in a charge, 50 per cent. of which is pig, 30 per cent. our own scrap, and 20 per cent. foreign scrap. We know from our daily shop analyses just what is in this charge, except in the case of the foreign material. This, however, can be approximated, light pieces running about 2 per cent. and heavy about 1.50 as a

minimum. Our charge, based on the method of actual weights and net percentages, would be:

| | | | | | | |
|---|---|---|---|---|---|---|
| Clifton No. 1... ... ... | 900 lbs. | @ | 3.10 | silicon | = 2790. | points. |
| Sterling Scotch No. 2.. | 450 " | @ | 2.20 | " | = 990 | " |
| Sidney No. 2... ... ... | 150 " | @ | 1.60 | " | = 240 | " |
| Sprues (our own).. .. | 900 " | @ | 2.20 | " | = 1980 | " |
| Scrap (foreign).. .. .. | 600 " | @ | 2.00 | " | = 1200 | " |
| | 3000 " | | | | 7200 | " |

or the charge contains 7200 divided by 3000, equals 2.40 per cent. As the loss usually is .20 for Mr. Scott's class of work (it may vary in others) there remains 2.20 per cent. silicon for the castings, which is right. Sulphur can be figured out similarly.

---

## SCABS AND BUCKLES.

*The Foundry*, Dec., 1900. Mr. Edward B. Gilmour gives another of his practical articles on foundry subjects. Scabs and buckles are among the serious annoyances constantly recurring in every foundry; they are unsightly, and their prevalence in certain sections gives the castings coming from them a very bad name. A scab is a raised part of the casting showing that some part of the mold has dropped away. This may have been in the gate. Then again the sand may have been too wet, or may not have been of the right grain to vent properly. A buckle, on the other hand, is a fold in the casting which shows signs of the finished mold having been pressed into it. There are many theories extant on this subject, and everyone believes he is right. In many shops it is the custom to build up all cores for loam work with loose joints, to facilitate the escape of gas. Mr. Gilmour holds that this is wrong, and that it is essential that all points should be perfectly tight. If this is not done the air in the spaces becoming heated will expand and push out into the liquid metal, breaking the loam off the face of the brick and thus the opposite result is obtained from that intended. It is well, therefore, to pour the mold quickly and keep the risers closed so as to maintain a pressure in the mold, thus holding the face intact until the metal reaches the top. Flat plates are best cast inclined

XUM

at about 25 to 30 degrees and poured from the lower end. In heavy dry sand work it is well to cut a ridge all around the mold about 5 inches from the pattern and vent in this ridge every 4 inches clear down to the bottom. This will take care of the gas and always save buckling. The so-called veins in loam castings are really buckles caused by the face of the mold breaking out into the metal as a consequence of pressure from gases in the mold, which is relieved easiest in this way. These veins are very unsightly and are often caused by the men blacking the mold. If they find cracks they will widen them out and fill up with fresh loam. This again shrinks and leaves a fine vein. It were better to use a little softer loam and fill the fine cracks deeper and thus prevent the imprisoned heated gases from blowing inward into the iron.

---

## BITUMINOUS COAL FOR THE CUPOLA.

*The Foundry*, Jan., 1901. Dr. Edward Kirk gives some of his reminiscences in a short article. Among all the foundrymen who could be recalled twenty-five years ago but three remembered melting with soft coal. Many used charcoal, and all of them now find coke and anthacite the cheapest. Unfortunately no record was kept by the three foundrymen, but Dr. Kirk himself used some of the harder grades of bituminous coal quite successfully by making his charges lighter and using a ratio of 5 to 1. As this is as good as many founders can do with small cupolas and light outputs, it opens up the question whether it would not pay those so situated to use some of the very hard bituminous coals in their vicinity instead of importing coke.

---

## HOT IRON.

*The Foundry*, Oct., 1900. Dr. Edward Kirk discusses hot iron, meaning by this, of course, an iron which is quite beyond the point necessary simply to melt it. The temperature of really hot iron should be sufficient to enable the founder to pour light or heavy work indiscriminately and yet obtain clean, sharp castings true to pattern. This really means a white heat in the ladle and a holding of this metal long enough to pour each mold in

succession at a point of heat best suited for the work. As some foundrymen are apt to get their iron dull and then hold it awhile before pouring, in order to avoid any possible cutting, Dr. Kirk advises them that castings are wanted, and molds should be made to suit these, and not castings to suit the molds. This, of course, means the proper facings, molding sands, etc., and their cost will not be found higher than the inferior material. For heavy castings, of course, the requirements of hot iron can be relaxed a little, but after all by the time the ladle is full it has already cooled sufficiently to allow pouring. Quick melting is rather beneficial than otherwise, for it is the dull, slowly melted iron which is burnt and dirty. Dr. Kirk again advises to melt hot and pour hot, thus insuring clean iron and good castings.

---

## EFFECT OF OXYGEN ON COPPER.

*American Institute of Mining Engineers*, Mr. E. S. Sperry, of Bridgeport, Conn., explains the effect of furnace gases upon various alloys and metals. In some cases it is merely the formation of a film which can be removed and still leave the metal pure, as in the case of lead, tin, or zinc, the process of removing the dross being merely a mechanical one. In the case of copper, however, the result is quite different. A sub-oxide is formed which is soluble on the metal and hence the surface of the metal remains bright. Now, as most of our copper contains a small quantity of this sub-oxide, left there purposely to offset the effect of arsenic and bismuth, which are usually also present in the copper, it becomes an interesting study to see just what the effect of varying quantities of oxides present in the copper will produce. The experiments were made by adding saltpetre to ingot copper melted in plumbago crucibles. In this way copper test pieces were obtained which contained from .10 to .22 per cent. oxygen. Further tests were made by simply melting copper and then removing the cover and allowing air to play upon the surface for several hours. The result was material with up to 1.52 per cent. oxygen. All test pieces broke "short," showing that the tenacity of the copper was destroyed. When this oxidized copper was mixed with zinc to make brass, spluttering and even explosions resulted, enormous clouds of zinc oxide

forming. The brass thickened and finally solidified. A complete series of experiments were now made to test the rolling qualities of the brass made with but small amounts of oxygen, and the general conclusions arrived at are as follows: Unless present in large quantities, oxygen does not exert a deleterious effect upon brass intended for rolling purposes. If oxygen is present in excess salamanders are formed which quickly show up carelessness on the part of the melter. The amount of oxygen which exists in Lake copper is .012 per cent., and in electrolytic .010 per cent.

---

## WAGES, THE MOTHER OF PROFIT.

Our friend and fellow member, Mr. E. H. Putnam, the foundry philosopher of the "Tradesman," has published an interesting and critical study on the subject of wages. The question is too deep to discuss with a mere "review," and hence a running narrative of the arguments follows herewith. John Stuart Mill contends that high wages mean low profits, no matter how you turn the question. Mr. Putnam, on the other hand, says that this may be so were it not for the fact that production is increased with higher wages and all prices are not equally responsive to the laws of supply and demand. There are, in fact, two kinds of prices, the nearly fixed, and the variable; the latter are those of the commodities which respond readily to the laws of supply and demand, such as food, clothing and machinery of production and distribution; the former are taxes and interest upon debt, etc. When the yearly gross amount of each of these two grand divisions are footed up, they will be found to be of enormous volume. Another feature of the difference in the two classes of prices is of interest. In times of depression the proportion of nearly fixed prices to the variable goes up quite rapidly, as taxation remains the same, or, if anything, is increased through crime and pauperism. Then there are the prices which custom has practically fixed, not to speak of the fact that taxes, bonds and interest go ahead of all other payments.

In order to investigate a general rise in wages, suppose we designate some proportion of a given wage to go to the fixed prices, say 25 per cent., and that the daily product per man brings

the employer a profit of, say, 50 cents. Figuring this out on the basis of a wage of $2.00 a day we find that 50 cents are consumed by the fixed expenses, leaving $1.50 for the variable. The amount of profit consumed by the fixed prices is 12.5 cents, and that of the variable 37.5 cents. Suppose now, wages generally are cut, say through lack of profit, the result of competition, the consequence will be an absolute diminution of purchasing power on the part of the workmen. The fact that the country is depressed, according to Mr. Putnam, will be found in the demand made by the fixed prices from both wages and profit. Since the employer cannot well raise prices in ordinary times, he has to resort to cutting wages if he wants more profits; then competition comes in and cuts his profits, and the ultimate result is that both wages and profits are diminished. One result of all this is the gain of those who collect the fixed prices. Now, the prosperity of a country brings with it enlarged producing power, and as the productive power increases prices will fall, and as capital is a product of labor, the more capital labor produces the less will be its value. The tendency of society is to diminish profit on the piece and use less men to make it; the correlative of which is man's rising value. Fortunately there is a limit to reduction in wages and profits, because employers do not generally wish to pay their men less than living wages, and workmen will not work for less. This alone saves us from utter ruin in hard times, when everything is hammering prices downward. In periods of great depression there is much capital and labor idle which if set to work would soon right things. What it needs is business confidence (and this is slow coming) and high wages and prices. Mr. Putnam gives as the solution that wages should be raised until there is enough demand to keep everybody busy, and then keep these wages high and do not raise the tax and fixed prices unless for value received. In this way one class would not enjoy prosperity while another languishes.

The trouble with us is that we do not fully understand the laws of distribution, as based upon prosperous times sustained by a high wage rate. The moment the balance of supply and demand is destroyed by a reduction in the wage rate trouble begins, for while we cut our workingman's wages competition cuts our profits. Organization is the key-note in perfecting arrangements which overcome these troubles. Let wages and

XUM

prices drop below a given point and the fixed prices consume so much of the industrial income that nothing is left to buy commodities with. Ireland is an example of this—the result can only be industrial ruin. Here is where the value of organization comes in, employes will not stand too great a cut, and on the other hand organized employers will not permit one of their number to go below the requirements of common decency in dealing with his men. Mr. Putnam adds some pertinent facts on life as it exists in the lower strata of society, and incidentally discusses the ethics of our industrial system without gloves. He concludes with the prediction that the vastly increased productiveness of system and of highly economized labor equitably remunerated will rightly lead to reduction of the hours of labor for both wage earner and giver. It will also remove the greatest evil of the competitive system—the power of selfish men to reduce wages below the standard, thus causing increased hardships to all.

## "SULPHITE" LIQUOR IN THE FOUNDRY.

*Eisenzeitung*, Feb. 7. The liquor coming from the manufacture of sulphite cellulose, and now thrown away as a useless by-product, seems to have found a place in the foundry. Instead of causing endless annoyance to the manufacturer who comes in conflict with the State for polluting streams, a cash value is received in Austria. It is used as a core compound, replacing molasses water, rosin, sawdust, horse manure and the like ingredients of a desirable core mixture. It is claimed that old sand can readily be used over again with this material, the result being much finer cores. Especially in the manufacture of pipe does the value seem to come in, as the resistance of such cores to the hydrostatic pressure of the liquid iron is much greater than that of the ordinary kind, and hence the castings run very uniform in weight. It is possible that our founders situated near such sulphite works may profit by this information.

## STRAINS IN HOT ROLLS.

*Tin and Terne*, Feb. 21, 1901. Our old friend, "Fer Blanc," gives us some further information on the interior conditions of a roll when in service. As cast iron expands about .0000062 of

its length for each increase of one degree F., a 26 inch roll would increase in circumference about one-twentieth of an inch for every 100 degrees. These figures show what unavoidable strains are likely to arise when the roll is put into service. It takes some time for the heat to travel into the interior, and similarly for the heat to travel outward after rolling hot metal ceases. From the construction of the roll one would suppose that the neck is perfectly safe and that the middle of the roll would give away first. This is not always the case, however, as many a roll breaks through the neck. Internal strains, due to undue heating by friction in the bearing, seems to offer the only explanation for this phenomena. It is therefore necessary to adjust the brasses with the utmost care. The top roll should be set forward toward the roller about $\frac{1}{8}$ inch, as compared with the lower roll. A plumb bob suspended along the center marks in the end will quickly give this distance accurately. Especial attention should be paid to the side brasses of bottom roll next to the roller, as the pressure on these is greatest. Occasionally a roll will break in consequence of an old crack, and it is well to trace, if possible, whether the crack gradually became greater, or if the roll went all at once, this to determine whether the treatment given the roll was wrong all along. To determine this, wet the fracture and expose it; the old crack will not rust as heavily as the more recent one.

---

## COST KEEPING.

*Engineering Magazine*, Jan., 1901. Mr. J. N. Gunn considers this subject one of fundamental importance, and even those who do not have the faintest suspicion of what cost keeping means agree heartily with him. In our days cost keeping is not only the work of an accountant, but that of the engineer, and he must know enough of industrial affairs to enable costs to be prepared properly and have them made readily accessible at all times for comparison, for costs have no value except in comparison so that action may be directed by experience. The organization of an enterprise must, therefore, be up-to-date and facts handled so quickly that they may be useful before conditions change and interest has waned. First we must have a

XUM

clear definition of the departments of the business so that similar work may be grouped in one department; second, a positive definition of duties of each department and its relation to the general business; third, a clear fixing of the responsibility and a willingness to have responsibility rest with the heads of the various departments; fourth, a proper distribution of the orders of the chief executive, so that the responsibility may be located without trouble and cost keeping simplified; fifth, a proper arrangement of commercial accounts so that each ledger account may give statistics of the various classes of direct and indirect expense. Also a profit and loss statement should be shown monthly. Sixth, a good head to the department of cost keeping who should be accountant and engineer as well, so that he may be able to use the results of his figures to reduce costs. His work will be no sinecure if properly performed. It is further essential that the end sought for in all this work be known before, as it will save much unnecessary labor, for it has often been found that the information obtained has cost more than the money which was afterwards saved by applying the remedy. What is usually wanted is final costs, that is, of the completed work at the door of the factory, and then this plus the selling cost. Again, we often want partial costs, such as for parts of machines, or brass and steel at some stage of the process. Then we may want comparative costs, that is, the cost of one period to another, or a comparison of the same thing at various plants controlled by the same corporation. Direct labor costs are also essential in determining whether piece work or day work shall be the rule. Finally come indirect costs, which shall serve as the basis of future changes in the operation of the plant.

A centralization of the stores of a factory is also essential, in order to control all material, stop any thefts and aid in establishing costs in this direction. The material may not be stored all in one place, but should be under one responsible storekeeper. This move will always be found a valuable cost saver in any factory. Finally it is to be said that any system that is introduced should be complete. It should be under the direct supervision of the chief executive himself, and not be entrusted to the mercies of a clerk or any other man good for selling but not manufacturing. A good cost system is invaluable in aiding the executive to determine the remuneration of the employes.

Their value is soon seen by what they produce. In many cases much dissatisfaction and bitterness could have been avoided if the real facts had been known as shown by the actual value received. Labor has continually suffered by the ignorance of capital concerning its own ventures, and on the other hand capital has been cheated right and left by the inability to detect gross leaks and inefficiency on the part of its help. The science of production is the constant study of the heads of successful enterprises and the discovery, study and collation of facts are the work of the industrial engineer.

---

## CHEMISTRY AND PHYSICS OF CAST IRON.

*Journal of the Franklin Institute,* Nov. and Dec., 1900. In May, 1900, Mr. P. Kreuzpointner, of Altoona, Pa., wrote an exceedingly interesting paper, entitled, "Riddles Wrought in Iron and Steel." In it mention was made of some phenomena in cast iron, and this precipitated an extended discussion, in which many of our prominent metallurgists took part. Prof. Howe asks a few questions which may also have occurred to our foundrymen. What composition gives the strongest cast iron? Will the strength go up as the total carbon goes down? We know that cast iron consists essentially of a white cast iron or steel, with graphite interposed. Steel with 1 per cent. carbon is most tenacious, and therefore every amount above this means a weakening. For this reason the air furnace makes so much better iron, as it reduces the carbon. So that the blast furnace, by necessarily saturating the iron with carbon while desulpherizing, makes really a very weak article.

Mr. Outerbridge, replying to this, states that the strongest iron for a small casting is not at all the strongest for a very large one, so that it is impossible to give the correct answer here. In general, however, cold blast charcoal iron combines, in the highest degree, strength and ductility. Mr. Outerbridge disagrees with Prof. Howe on carbon weakening cast iron, claiming that charcoal iron which is very strong is also very rich in carbon. He also claims that the reason air furnace iron is so much higher than cupola iron is because the metal is less in contact with the blast, or, in other words, is less oxidized.

XUM

Mr. Webster discusses the annealing effects, when cast iron is thus treated, as affecting its resistance to shock. He incidentally gives credit to our Association for urging the better training of our coming foundrymen. This means that the knowledge which foundrymen are known to possess will be given more freely, and the quality of the castings made considerably enhanced. Mr. Webster asks some interesting questions to answer which will puzzle many a foundryman. Given the breaking load of one inch test bars, their deflection and chemical composition, can you closely approximate the results obtained from this metal in small, medium and large-sized castings? The results of the A. F. A. Committee on testing cast iron will throw considerable light upon this question. Again, Mr. Webster wants to know if fracture indications are used to make up mixtures, or composition only. Given the composition of the charge, what will be the result, and can you arrange to get just what you want? All things running properly, can you estimate the strength of your test bars from your cupola charge? All these could be answered very readily were it not for the item of cupola practice. With iron liable to be oxidized in the cupola, accurate predictions are impossible, though approximations can readily be made, and daily practice has amply proven them quite reliable. As a final question Mr. Webster asks what elements are used in estimating the strength of test bars, meaning possibly a comparison with his well-known studies on predicting the strength of steel from the composition. Unfortunately cast iron is not as homogeneous a substance as steel, and therefore such estimations are liable to come out quite differently than expected. Foundrymen have, therefore, not attempted to do more than study the effects of silicon and the carbon contents and made their predictions on that basis only.

Mr. Outerbridge and Mr. Whitney answer these questions from their particular standpoints, giving many instances and examples of daily foundry practice which are quite familiar to us. One point, however, Mr. Outerbridge emphasizes, and which cannot be brought out too often, and that is the presence of dissolved oxide in the iron, which weakens it. Were more attention given to this fact, so often discussed by your Secretary also, many curious weaknesses in castings would be easily understood.

Mr. Kreuzpointner sums up the evidence and expresses his pleasure that the discussion of riddles wrought in iron and steel has drifted into that "coy and intricate subject—cast iron." Indeed, this metal presents many riddles still to be solved, and the interest manifested should encourage foundrymen in the pursuit of knowledge in their particular branch. The foundryman should join with the scientist and make the combined results thus obtained accessible to the world. Mr. Kreuzpointner reviews the results of the A. F. A. Committee on testing cast iron, and makes some highly interesting comparisons, arguing that cast iron is not so bad a substance after all, and can be used for many purposes, where it is the very best material for the object sought. The question of segregation is recommended for our study, as here will be found the secret for many failures. Mr. Outerbridge, Prof. Howe and Mr. Putnam add some further interesting data, and this closes what has turned out to be a most thorough discussion of a subject which is periodically attacked and always shows up a little better after each set-to. By and by we will know a great deal more of our "mainstay" if we only keep on hammering at it with energy and discretion.

---

## INTENSIFIED PRODUCTION.

*Engineering Magazine*, January. Mr. Milton P. Higgins develops a new line of thought in discussing the effect of intensified production upon the worker. We are all after the placing upon the market of articles which are cheaper and better than those there at present, and hence we must work for both quality and quantity. In olden times men desired to produce something which was superior to anything existing, for the sole desire to have it thus even if it cost a lifetime. To-day the use of machinery produces the highest class of results within reach of poor and rich alike. To do this properly means organization of the highest type. All this means invention and study, and the opportunities of the educated mechanic and engineer are becoming limitless. Again, every man affected, whether president or mechanic, has the same kind of personal feelings which must be dealt with. He has a family to support, to educate, and people often think that in his tenement home at night, and sitting by a machine all day doing the same thing over and over again, the

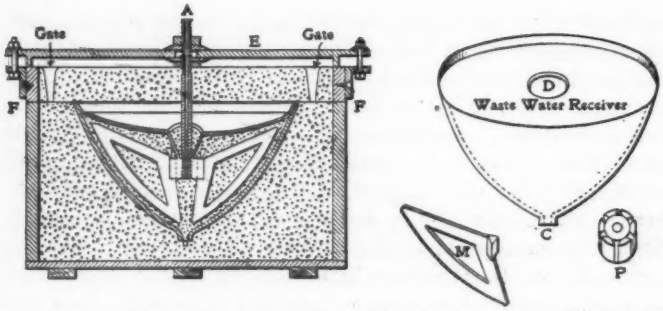
XUM

mechanic must have a dark and dreary future before him. Now, there is something in this, of course, but after all the mechanic has one thing which did not exist in so great a measure before—the opportunity. First he has the opportunity and means for a decent existence. Second, he has a demand for a little thought and action. Third, to do more and be a little better by personal effort. Fourth, relief from the hard, muscular work and unhealthy conditions. Fifth, better social advantages and conditions. Sixth, opportunity for culture and education. Even an automatic machine requires a brain to run properly. There must be some oil applied here, a nut tightened there, and a man who loves his work will find his mind occupied at all times, even when everything is automatic. To love his work this man needs encouragement and help, and in America he gets this. Get a batch of ten boys in America at work in the poorest factory you may find, and in three days nine of them will ask the tenth what to do next. Thus one boy has begun to think. Working and thinking go together, and with this thinking comes the application of the creative power. We have splendid engineers in this country, but the great bulk of our workingmen do not get enough of that education which they should have to produce the best results for themselves and their industries. There is still a great need for industrial education.

---

## THIN CASTINGS.

*American Machinist*, Feb. 28th. Mr. L. C. Jewett, who occasionally remembers us with a paper, idscusses the molding of thin castings, calling attention to the difficulties which must be overcome. For work like tea kettles, soil pipe and hollow ware in general, where dry sand cores cannot be used, if uniformity in the thickness of the castings is desired, it is quite a problem to get up green sand collapsible core arbors which will be strong enough, and at the same time enable the generated steam and gases to escape. The sketch herewith shows such a casting, a waste water receiver for passenger cars. The valve C in the drain pipe is opened or closed as occasion requires it; a small opening, D, 4½ inches in diameter, and the small hole in the bottom, C, are the only perforations in the hollow shell. M shows one of the six wings to carry the green sand core; the little dovetail fits




loosely into the female dovetail of the hub P. Wooden wedges secure the wings properly. H is a piece of gas pipe threaded at each end and secured well in the hub, P. The top plate of the pattern is removable in order to insert the arbor and properly ram the core.

In molding up put the drag and pattern upside down upon a mold board, ram up, turn over and remove the follow board. Lay on 1½ inches to 2 inches of molding sand, which is not too damp, on the inside of the pattern. Clay-wash the anchors and place them firmly into this sand. Now put on the top of the pattern and ram up the cope. It is well to protect the screw with a larger piece of pipe, which can be left in until the mold is cast. The cope being made, remove the long pipe and lift the cope off. Draw out the top plate of the pattern, finish the cope and top of the core. Replace the cope, remove nut down at the top end of the pipe and screw this firmly into the hub of the arbor. Now put on binder E and bolt this to the brackets FF. Now back up the nut under the binder tight and lift core and set upon horses. Finish up as usual, close and clamp. After casting shake out when cool. The wooden wedges come out, then comes the center of the core, and finally the wings, which, of course, must be small enough, otherwise they would have to be broken in each case.

---

## SOLDERING ALUMINUM.

*Cassier's Magazine*, March. Mr. J. A. Steinmetz gives his views on this subject, so important to the foundry, in view of

the manifold uses of aluminum in pattern making. We in America seem to have greater success in this matter than our European friends. Aluminum is peculiarly refractory to the acceptance of a fusible alloy which will satisfactorily unite its surfaces or margins. The reason for this is entirely physical. It will be found that there is always present a thin continuous coating of oxide on the surface, which eectually prevents the solder from getting at the true metal beneath. Now, this coating is of an instantaneous formation; and not even a scraping will prevent the surface to be immediately coated with this almost invisible film.

Dr. J. W. Richards, of Lehigh University, solved the problem by making an alloy of phosphorus with tin; the phosporus attends to the oxide film and the tin unites with the surface. Another trouble with aluminum is its high heat conductivity. Heat is drawn so rapidly from the soldering iron that the solder "freezes" and the result is a failure. It is, therefore, advisable to keep the iron exceedingly hot as well as to preheat the parts to be soldered. The high electromagnetic property of aluminum further aggravates the difficulty in soldering it, for a galvanic action is set up between the aluminum and the solder, which results in disintegration. Zinc is most commonly used in the ordinary commercial solders for aluminum, but the disintegrating action soon spoils the results obtained with them. A good commercial solder must take hold easily on the aluminum, must be conveniently handled without complicated tools and fluxes, must melt readily, be strong, malleable and tough, must not contain elements which aid in disintegration, should be of the same color as aluminum, and should not tarnish with age. Dr. Richards' solder conforms to all these requirements fully.

---

## MOLDING LOSSES.

*Stahl und Eisen*, Nos. 20 and 21. Dr. F. Wuest, of Duisburg, recently made an address on the title subject before the German Foundrymen's Association, in which he discusses the matter thoroughly. Aside from the use of the wrong kinds of pig iron and imperfect appliances for melting and handling the metal, we must give our careful attention to many details in the

foundry if good castings are to result. Our ladles must be well daubed and thoroughly dried, using about one part of clay to two of fire sand, and mixing the mass with about twice as much horse manure (using hay rope for pipe cores does not look so bad after this.) After the lining is thoroughly dried it is blackened with two parts, by volume, graphite, one of fire clay and one of ground fire brick, mixed and washed on. The fluid iron in the ladle must be protected from the cooling effect of the air as much as possible, charcoal, ground coke or sawdust being best adapted for this purpose. It is good to let the iron stand a little so that the manganese and silicon can act upon the iron oxide present and remove it as well as the gases which may have been dissolved. Sulphur is also reduced in this way slightly. Dr. Wuest recommends the use of a very small quantity of tin in the melted iron to free it from gases and dross. Similarly .02 to .05 per cent. of aluminum can be added to advantage, in this respect approaching our own practice. The iron should be carefully skimmed before pouring and some molding sand thrown on to protect it from oxidation and excessive loss of heat. There are a number of devices which are intended to skim the iron automatically. The use of a special pouring basin is also recommended, as in this way iron can be poured rapidly and enter the mold clean. Several of these basins are shown, which look pretty elaborate, but are said to be quite efficient for bath tub work and the like. A careful observance of this feature will do away with much molding loss.

Another peculiar gate is shown, in which a fairly large sphere is molded up in the middle of the runner, this entering it on the tangent. The idea here is to cause the iron to rotate rapidly as it is poured and thus separate out the slag and dirt. This is an adaptation of the whirl gate used in pouring rolls, which Dr. Wuest also shows in great detail. The passage for the melted iron should be as clear as possible, as any thin edges are liable to be washed off, and cores will sag or spall off if hit squarely by the stream. Several examples of good and bad practice in this particular are given.

Next the question of risers is taken up, their location being given and functions explained. The use of clay plugs, so commonly used here, is commended, as the gases formed in a large green sand mold are so great that open risers may lead to trouble

XUM

while pouring. An interesting point in connection with the casting of rolls is the addition of aluminum to the sink head to keep it fluid while pumping. The melting point of the iron being lowered by the addition of aluminum, it remains fluid much longer. Venting cores is a most important item to be looked after if good castings are to be the rule, similarly the use of good chaplets. Dr. Wuest describes a new form of chaplet which is made of aluminum and is used for castings where it is essential that the chaplet does not show afterwards. It can only be used for supporting a core, however, and not to prevent it from lifting up, as the aluminum melts away fast. For this reason, also, it is necessary to fill up the mold quickly. The article is copiously illustrated, and should have been labeled "special molding methods" instead of "the origin of defective castings," as this is difficult to trace.

KUM